

Evaluating Climate Change Adaptation Readiness of Caribbean Island Nations in
Relation to Communities, Fisheries and Fishing Communities

By

Nicholas Kofi Deklu

A Thesis Submitted to Saint Mary's University, Halifax, Nova Scotia in Partial
Fulfilment of the Requirements for the Degree of Master of Arts in International
Development Studies

April, 2015, Halifax, Nova Scotia

© Nicholas Kofi Deklu, 2015

Approved: Dr. Tony Charles
Supervisor

Approved: Dr. Danika van Proosdij
Reader

Approved: Dr. Cathy Conrad
External Examiner

Date: 30th April, 2015

Evaluating Climate Change Adaptation Readiness of Caribbean Island Nations in Relation to Communities, Fisheries and Fishing Communities

By

Nicholas Kofi Deklu

ABSTRACT

Fishing communities are dependent on natural resources for their sustainable livelihoods especially in developing countries. The Caribbean is one of the most vulnerable regions to the impacts of climate change with unprecedented sea level rise, severe weather conditions such as hurricanes, coastal erosion and loss of infrastructure and livelihoods. The idea of climate change adaptation plans and programs is therefore recognised among governments and relevant stakeholders as crucial especially in developing appropriate strategies and interventions. It is important for these adaptation plans and policies to be evaluated to ascertain their efficiency, effectiveness and also to measure the level of community involvement. In order to evaluate government level climate change preparation, with a focus on fisheries, communities and fishing communities specifically, Ford and King (2013) climate change adaptation readiness framework with potential components and indicators for evaluating readiness for adaptation was adopted. This analysis included evaluating political leadership on adaptation; institutional organisation for adaptation; adaptation decision making and stakeholder involvement; climate change information and research; funding for adaptation planning and evaluation; and science and technology to inform adaptation. Findings from the study indicated significant differences in adaptation readiness scores across the 13 island countries in the Caribbean. Only three countries were identified to have high adaptation readiness scores, eight countries were categorized as having moderate adaptation readiness scores, and two countries obtained low adaptation readiness scores. The findings are important as it will help to identify trends and gaps in climate change adaptation response and to develop appropriate governance strategies for communities, fisheries and fishing communities.

30th April, 2015

DEDICATION

To my parents Mr. Robert Attah Deklu and Ms. Felicia Adjoa Adjei

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my supervisor, Dr. Tony Charles, for his outstanding guidance, tolerance, and providing me with an excellent atmosphere for doing research. Thank you to my committee, Dr. Danika van Proosdij and Dr. Cathy Conrad for the valuable contributions to my academic work.

I would also like to thank the Partnership for Canada-Caribbean Community Climate Change Adaptation (ParCA) for providing funding for this study. Special thanks to Dr. Ahmed Khan and Dr. Susanne Marshall for guiding my research and helping me develop my background in critical writing, presentation and analytical thinking. Special thanks to Obed Owusu, Gladstone Deklu and Mark Amegadzie for your unsurpassed suggestions and corrections.

To my parents and siblings, thanks for your support and encouragement. Finally, I would like to thank my wife, Faustine Deklu for cheering me up and standing by me through the good and the bad times.

Table of Contents

Chapter 1: Background Information	1
1.1 Introduction	1
1.2 Context: Status of Climate Change Adaptation and Development	2
1.3 Issues: Community-Based Participation, Fisheries and Climate Change Adaptation Readiness.....	6
1.4 Research Question.....	9
1.5 Thesis Statement	9
1.6 Methodology	10
1.7 Thesis outline	11
1.8 Limitations of this research	12
Chapter 2: Literature Review	14
2.1 The Connections between Climate Change Adaptation, Fisheries and Community-Based Participation.....	14
2.2 Introduction	14
2.3 Climate Change Adaptation	15
2.4 Climate Change Adaptation and Community-Based Participation Nexus.....	17
2.5 Linking Climate Change Adaptation with Fisheries and/or Fishing Communities .	21
2.6 How Ready are Countries and Organisations for Climate Change Adaptation?	22
Chapter 3: The Caribbean Region	25
3.1 Fisheries and Fishing Communities in the Caribbean.....	26
3.2 Fisheries Sensitivity to Climate Change Impacts in the Caribbean	29
3.3 Programs, Projects and Policies to Adapt to Climate Change Impacts in the Caribbean	33
3.4 Vulnerability of the Caribbean Small Island Developing States (SIDS) to Climate Change.....	36
Chapter 4: Research Methodology	40
4.1 Methodological steps and data collection	40
4.2 Methodological Modeling	41
4.3. Components for Adaptation Readiness Evaluation and their Indicators.....	46
4.3.1 Political Leadership for Adaptation.....	46
4.3.2 Institutional Organization for Adaptation.....	49

4.3.3 Adaptation Decision Making and Stakeholder Involvement.....	52
4.3.4 Availability of Climate Change Information and Research	54
4.3.5 Funding for Adaptation Planning, Implementation and Evaluation	56
4.3.6 Science and Technology to Inform Adaptation	58
4. 4 Compiling and Computing Indicator Scores	60
Chapter 5: Results.....	66
5.1 Adaptation Readiness Index by Country	66
5.2.1 Adaptation Readiness Index for Antigua and Barbuda	66
5.2.2 Adaptation Readiness Index for the Bahamas	69
5.2.3 Adaptation Readiness Index for Barbados	71
5.2.4 Adaptation Readiness Index for Cuba	74
5.2.5 Adaptation Readiness Index for Dominica.....	77
5.2.6 Adaptation Readiness Index for Dominican Republic	80
5.2.7 Adaptation Readiness Index for Grenada	83
5.2.8 Adaptation Readiness Index for Haiti.....	85
5.2.9 Adaptation Readiness Index for Jamaica.....	87
5.2.10 Adaptation Readiness Index for Saint Kitts and Nevis	90
5.2.11 Adaptation Readiness Index for Saint Lucia	92
5.2.12 Adaptation Readiness Index for Saint Vincent and the Grenadines	94
5.2.13 Adaptation Readiness Index for Trinidad and Tobago.....	97
5.3 Adaptation Readiness Index by Component	99
5.3.1 Readiness Index for Political leadership on Adaptation.....	99
5.3.2 Readiness Index for Institutional Organisation for Adaptation	102
5.3.3 Readiness Index for Adaptation Decision Making and Stakeholder Involvement	104
5.3.4 Readiness Index for Climate Change Information and Research	107
5.3.5 Readiness Index for Funding for Adaptation Planning and Evaluation	109
5.3.6 Readiness Index for Science and Technology to Inform Adaptation	112
5.4 Synthesis of Results	114
5.5 Connecting Adaptation Readiness Average Scores and Socio-Economic Indices	120
5.4.1 Adaptation Readiness Average Scores and HDI	121

5.3.2 Adaptation Readiness Index Average Score and GDP Per Capita	123
5.4.3 Adaptation Readiness Index Average Score and the Fishery (% of GDP).....	125
Chapter 6: Discussion	128
6.1 Introduction	128
6.2 Major Development Issues and Lessons	128
6.4: Adaptation Readiness and Socio-Economic Indicators	133
6.5 Influencing Factors.....	136
6.6 Synthesis.....	143
Chapter 7: Conclusion and Recommendations	151
7.1 Conclusion.....	151
7.2 Recommendations for Further Research	155
References	157
Appendix.....	173

LIST OF TABLES

Table 1: Components and their indicators.....	41
Table 2: Detailed description of indicator scores.....	63
Table 3: Distribution of adaptation readiness index obtained by countries.....	111
Table 4: Relevant socio-economic data based on 2012 estimates.....	115

LIST OF FIGURES

Figure 1: Map of Caribbean showing the regions vulnerable to climatic changes.....	25
Figure 2: Summary of climate change impact on fisheries.....	31
Figure 3: Vulnerability of Small Island Developing Countries in the Caribbean.....	38
Figure 4: Adaptation readiness framework and model.....	41
Figure 5: Adaptation readiness index for Antigua and Barbuda.....	67
Figure 6: Adaptation readiness index for Bahamas.....	69
Figure 7: Adaptation readiness index for Barbados.....	72
Figure 8: Adaptation readiness index for Cuba.....	75
Figure 9: Adaptation readiness index for Dominica.....	78
Figure 10: Adaptation readiness index for Dominica Republic.....	81
Figure 11: Adaptation readiness index for Grenada.....	83
Figure 12: Adaptation readiness index for Haiti.....	85
Figure 13: Adaptation readiness index for Jamaica.....	88
Figure 14: Adaptation readiness index for St Kitts and Nevis.....	90
Figure 15: Adaptation readiness index for St Lucia.....	93
Figure 16: Adaptation readiness index for St Vincent and the Grenadines.....	95
Figure 17: Adaptation readiness index for Trinidad and Tobago.....	97
Figure 18: Readiness index for political leadership on adaptation.....	100
Figure 19: Readiness index for institutional organisation for adaptation.....	102
Figure 20: Readiness index for adaptation decision making and stakeholder involvement.....	105
Figure 21: Readiness index for climate change information and research.....	108

Figure 22: Readiness index for funding for adaptation planning and evaluation.....110

Figure 23: Readiness index for science and technology to inform adaptation.....112

Figure 24: shows the performance of countries represented geographically.....119

Figure 25: Adaptation readiness average score versus HDI, by country.....123

Figure 26: Adaptation readiness average score versus GDP per capita, by country.....124

Figure 27: Adaptation readiness average score versus fisheries as a % of GDP, by country.....127

LIST OF ACRONYMS AND ABBREVIATIONS USED

ACCC	Adapting to Climate Change in the Caribbean
CANARI	Caribbean Natural Resources Institute
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CCCCC	Caribbean Community Climate Change Centre
CCCRA	CARIBSAVE's Climate Change Risk Atlas
CDEMA	Caribbean Disaster Emergency Management Agency
CERO	Central Emergency Response Organization
CNRI	Caribbean Natural Resources Institute
CPACC	Caribbean Planning for Adaptation to Global Climate Change
CRFM	Caribbean Regional Fisheries Mechanism
CRRM	Center for Risk Reduction Management
DFID	Department for International Development
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organisation
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse gas
GIZ	Gesellschaft für Internationale Zusammenarbeit
HDI	Human Development Index
IDB	Inter-American Development Bank
IPCC	Inter-Governmental Panel on Climate Change

IUU	Illegal, Unreported and Unregulated
MACC	Mainstreaming Adaptation to Climate Change
MDG	Millennium Development Goal
NAP	National Action Programme
NAPA	National Adaptation Programmes of Action
NCSA	National Capacity Self-Assessment
NODS	National Office of Disaster Services
NSTC	National Science and Technology Council
SIDS	Small Island Developing States
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Program
USAID	United States Agency for International Development

Chapter 1: Background Information

1.1 Introduction

Climate scientists and researchers agree that the main threat facing low lying coastal regions in small island countries and fishing communities is climate change (Roessig et al 2004; IPCC, 2014). Global efforts are therefore in progress in order to reduce the dangerous impacts and effects of climate change. However, unless concerted actions are taken soon, climate change extremes may become inevitable (Walther et al, 2002).

The Caribbean region has recorded increasingly high rates of climate disasters with negative effects on economies and human security (Allison et al. 2009). According to Salas et al (2011), the region is vulnerable to the impacts of climate change with unprecedented rates of sea level rise, severe weather conditions such as typhoons and hurricanes, and coastal erosions causing loss of infrastructure and livelihoods. In the Caribbean region, very little has been done in terms of climate research, funding allocations, and policy implementation despite having the most number of small island developing countries (Tompkins, 2005).

Adaptation readiness and preparedness among governments have however become a pragmatic environmental management tool and an essential component of climate policy and research. Readiness ensures that vulnerable groups are able to adapt to changes. Ford et al (2013) argued that evaluating adaptation readiness is a very significant means of supporting climate change adaptation.

Considering the constrictions and limitations of this research, some published literatures may be have been overlooked. Some documents such as those found in grey

literature may be meaningless and might not reflect the real situation about readiness of countries in relation to communities and fisheries. Scores only look at the presence of communities, fisheries and fishing communities in documentations and this does not say anything about the quality of adaptation efforts by countries because results are based on only what is available in the documents and not actual on-the-ground results. Therefore, one does not know the true readiness of countries. Also, the results may either be overstating readiness or understating it and this depends on differences in documentation and reality (See section 1.8). However, this is a good first step towards a more integrated and comprehensive future research. This thesis aims to contribute our understanding to the extent at which countries in the Caribbean are prepared and ready to adapt to climate change in relation to communities, fisheries, and especially fishing communities.

1.2 Context: Status of Climate Change Adaptation and Development

It is widely accepted that climate change is inevitable and there is substantial evidence globally that climatic changes are already taking place all over the world (Smith et al, 2009). Scientific studies show that the world will experience increased precipitation and temperature, intense and frequent rain, wind storms as well as severe coastal erosion and sea level rise (Tol, 2009; IPCC, 2014).

Climate change poses severe risk to lives, livelihoods and economies, particularly for the world's poorest and vulnerable populations and it presents significant threats to sustainable development. The effects of climate change may reverse advancement towards achieving developmental aims most important, the Goal 7 (promoting environmental sustainability) of the Millennium Development Goals (Newman et al., 2012). Climate

change cannot be controlled until growth in both rich and poor countries becomes less greenhouse gas intensive and more concerned about adaptation and mitigation. Climate change threatens to oppose development achievements. This section emphasises climate change interaction with development, especially in developing countries.

Climate change may cause the depletion of natural resources, such as water, forest, land, among others. This will decrease the availability of potable water, reduce agricultural and fisheries productivity as well as increase climate-related disasters such as flooding and droughts (Rose, 2015). This as a result will reduce the livelihood assets of poor people, change the rate of national economic growth and destabilise food security (O'Brien et al., 2014; Ayers et al., 2014). For example, the Food and Agriculture Organisation of the United Nations (FAO) predicts that by the year 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity as a direct impact of climate change (UN Water, 2014).

Climate change will have a direct impact on environmental sustainability. Environmental sustainability involves making responsible choices that will decrease the negative impact of business on the natural environment. This is very important in attaining sustainable development since promoting environmental sustainability is the Goal 7 of the MDGs. Climate change will therefore have direct and indirect impact on this all important goal and as a result will cause major changes in ecosystem relationships, alter the quality and quantity of natural resources, decreases ecosystem productivity (Phillips et al., 2015).

The First IPCC Assessment Report (FAR) laid the basis for much of our recent understanding of climate change impacts and effects. For instance, reports included the

recognition that sea level had risen during the 20th century, that the rate of rise had increased compared to the 19th century (IPCC, 2014). The recent IPCC report also indicated that “ocean thermal expansion and the mass loss from glaciers were the main contributors to the 20th century rise, that during the 21st century the rate of rise was projected to be faster than during the 20th century, that sea level will not rise uniformly around the world, and that sea level would continue to rise well after GHG emissions are reduced” (Church et al, 2013).

For small island countries and fisheries, there is a critical need for adaptation strategies to meet the increasing frequency of catastrophes that will affect national economies and human security (Allison et al. 2009; Guillotreau et al. 2012). These changes suggest an increasing risk of flooding and coastal erosion which pose a threat to the world’s economic growth and sustainable development (Parry et al., 2004) of which fisheries and fishing activities are included.

Fisheries and fishing activities are vital contributors to food supply, food security and livelihoods especially in developing countries (Charles, 2008). Fish has a high nutritional value and is considered to be one of the most traded and exported food products for many countries in the world. According to the Food and Agriculture Organisation (FAO), fishing activities provide income and livelihoods to the ever-growing number of people around the world, mostly countries in the global south where employment resources are limited. FAO (2012a) estimates that about 200 million people and their dependants worldwide, most of them in developing countries, live on fishing occupations. Graham, Charles & Bull (2006) contended that fisheries and fishing communities are most dependent on coastal and marine resources for sustainable livelihoods. Based on these

assertions, changes in climatic conditions will have significant detrimental effects on communities, fisheries and fishing communities.

The Caribbean regions' fishing activities influence changes in climatic conditions which have resulted in the region already experiencing significant negative effects. The region's fishing activities are directly affected by changes such as sea level rise, temperature changes, coastal erosion, ocean acidification, and severe weather conditions (Salas et al., 2011). The greater Caribbean region has an approximate area of about 2.5 million kilometres and the largest number of small island developing countries in the world. With such a huge coastline, fishing forms one of its major economic sectors, employing approximately 2 million people and contributing \$6 billion per year in foreign exchange earnings (FAO, 2012a). Fisheries and fishing activities also provide 10 percent of the protein intake in the Caribbean. It is therefore imperative to implement sustainable policies and actions to alleviate the dire nature of the situation.

Climate variability and change typically involve two major actions, adaptation and mitigation. Adaptation refers to the preparedness of society to deal with the negative impacts associated with climate change (Dessai, & Hulme, 2004) while mitigation is ascribed to reducing the amount of carbon dioxide and other greenhouse gases in the atmosphere (Aldy, et al, 2009). Adaptation has emerged as an effective strategy in dealing with the inevitable effects of these anticipated climatic changes especially in developing countries (Hoffmann, & Sgrò, 2011). Adaptation supports the reduction of disasters, aids economic and social development as well as encourages community-based involvement in the decision making process of any country (Feldman & Kahan, 2007).

Additionally, since fisheries and fishing activities are susceptible to climate impacts, effective marine governance arrangements are essential for climate change adaptation purposes. Charles, (2012) agreed that there is the need for “management interventions and policy measures to ensure sustainability, and to achieve overall fishery goals and directions” (p.352). This is important in the midst of climate change crisis.

Given this state of changing climatic conditions, it is important for governments and relevant social actors to design and implement policies that can help to adapt but undertake this in a manner that includes participation, citizen involvement and empowerment. In other words, governments, institutions, international organizations, donors as well as civil society are critical in helping fishers, fishing communities and aquacultural activities in adapting to climate change. This assistance is in the form of designing, implementing and evaluating climate change adaptation policies and plans (Preston et al, 2011).

1.3 Issues: Community-Based Participation, Fisheries and Climate Change Adaptation Readiness

One of the most common obstacles to preparing for climate action in communities is the ability to involve people that are directly affected. The United Nations Development Program (UNDP) has come to an agreement that meeting the climate change adaptation challenge will require “collaboration across public and private sectors and the full engagement of civil society and indigenous peoples”. According to Sultana & Abeyasekera, (2008) community participation is popular in the development discourse and practice, mostly in developing countries and in relation to environmental and resource management.

In climate change policy, community participation can be explicated as the greater involvement of people in decision making, implementation and evaluation. Community participation and involvement is expected to increase the efficiency and effectiveness of these programs and projects.

Community- based participation depends on having a good understanding of the needs of societies, groups and individuals involved. For adaptation to be effective and operational, community- based interventions must be taken into account. This is likely to aid community support and also help identify community needs and priorities, build capacity and reduce any barriers to action (Paul, 1987; Kumar & Kumar, S. (2002). Relative to climate change, communities help reinforce the capacity of national and regional entities to receive and manage climate effects through collaborative relationships (Few, Brown & Tompkins, 2007).

Also, community-based engagements support adaptation and build resilience to counter changing climatic conditions. A consistent supposition from a number of studies and reports is that community participation involves people with comparable needs and goals to make decisions that affect their lives. Sharpe and Conrad (2006) argued that community groups develop a scientific database with usable ecological or environmental data and contributes positively to the management of their local natural resources. Communities could be categorised in different forms: coastal communities, forestry communities, farming communities, and for the purpose of this research, fishing communities.

Clay and Olson, (2008) define a fishing community as considerably dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs. Local communities engaged in fishing activities feed on and create revenue from fish and fishing related activities. Notwithstanding the presence of longstanding traditions for local fisheries sustainability, overfishing, environmental degradation and bad fishing practices as well as climate change has been identified as the major problems in the sector.

In the Caribbean, the problem of sustainable fisheries is aggravated by the increasing changes in climatic conditions. In the past years, the Caribbean region suffered from numerous climatic disasters in the form of floods and typhoons whose scales in terms of losses and damages, have disrupted the interest of international donors, governments and civil society's in providing assistance in the management of disaster risks. For instance, in 2004, a documented flood caused severe damages in the Caribbean islands, mainly Haiti and Dominican Republic with over 1,300 homes destroyed and about 2,000 killed due to landslides and drowning (Prevatt et al, 2010). Different reports and analyses predict "severe impacts, including loss and alteration of habitats, smaller and less-diverse fish stocks, and coral bleaching, and urges prompt action to help the Caribbean region's fishers prepare" (Stockholm Environment Institute, 2011).

Adaptation has therefore become an important option for most communities, specifically, fishing communities. According to Nurse (2011), since stopping climate change is beyond Caribbean fisheries' power, and negative effects are already being felt, 'adaptation is the only option'. These adaptation actions and options will help to improve

the resilience of habitats and key species. It also involves effective governance and co-management principles.

1.4 Research Question

This research focuses on evaluating the inclusion of communities, fisheries and fishing communities in the Caribbean climate change adaptation plans, policies and projects. The central research question is:

How and to what extent are the governments of the Caribbean islands ready to adapt to the impacts of climate in relation to communities, fisheries and especially, fishing communities?

Related to the central research question are further dimensions of research, such as:

- i. How does adaptation readiness differ between selected island countries in the Caribbean in dealing with communities, fisheries and/or fishing communities?
- ii. Why are some island countries in the Caribbean region more advanced on adaptation readiness than others in terms of communities, fisheries and fishing communities?

1.5 Thesis Statement

This thesis will argue that Funding for Adaptation Planning and Implementation is the main driver of whether or not a country has high or low adaptation readiness in relation to communities, fisheries and especially, fishing communities. Funding is necessary for science and technological innovations; information and research; stakeholder programs; institutional restructurings; and national reforms. However, there are different aspects of

this thesis statement that are significant to consider. While funding may be imperative for some indicators within a single component, it may not be the most important to all components. For instance, funding may not be the main driver for indicators such as national acts and legal frameworks, UNFCCC communications, and climate change conventions. Similarly, some indicators for Institutional Organisation like public engagement, inter-agency and cross sectorial partnerships may not necessarily be driven by funding. These indicators depend on and are contingent to other factors such as the political will of leaders and relevant stakeholders other than funding.

1.6 Methodology

Data on adaptation plans and projects were recorded on thirteen (13) island countries in the Caribbean. This study used data mainly from secondary sources in developing, determining and evaluating the governmental levels of adaptation readiness in relation to communities, fisheries and/or fishing communities. Secondary data was also collected and compiled from primary and grey literature.

The assessment of existing information from the above sources led to the selection of Ford and King (2013) adaptation framework to determine adaptation readiness levels. The framework comprises factors that inspire governments, funding organisations and stakeholders to act on climate change adaptation, vulnerability assessment, action plans as well as policy strategies for effective adaptation. These frameworks include Political Leadership on Adaptation, Institutional Organisation for Adaptation, Adaptation Decision Making and Stakeholder Involvement, Climate Change information and Research, Science

and Technology for Adaptation in addition to Funding for Adaptation Planning and Evaluation.

General policy review application and document examination were carried out considering key elements/concepts -‘communities’, ‘fisheries’, fish, and ‘fishing communities’ - in adaptation documents gathered. A consistent and systematic search for these key words were applied to documents, case studies, newspaper articles, blog posts, presentations and posters as well as relevant government websites. Chapter 4 extensively and comprehensively explain the methodology used in this study. It is important to state that the results for this research is based solely on what is found in documents gathered for this research and not actual on-the-ground research. The results do not also show anything about the actual situations in communities.

1. 7 Thesis outline

This thesis is divided into seven chapters: The remainder of this chapter provides a background on the status of climate change as well as presents current issues and concerns of the world’s climate change and why the need to adapt. It also touched on the limitations of the study. Chapter 2 provides an overview of climate change adaptation and its connections with communities, fisheries and fishing communities in a broad-spectrum. Chapter 3 discusses the state of the Caribbean region’s fisheries and climate change adaptation policy options. Chapter 4 describes the methodological steps and data collection approaches as well as components and criteria that are important in evaluating government level adaptation readiness. Chapter 5 presents the results for country to country and component to component findings. Chapter 6 gives detailed discussions and analysis on the

government level readiness to adapt in the Caribbean with primary focus on communities, fisheries and fishing communities. Finally, chapter 7 summarises the major findings, implications and recommendations for climate and development policy, and conclusions.

1.8 Limitations of this research

Although this research was carefully organised and has reached its aim, the study has its limitations and shortcomings:

1. This thesis only discusses the governmental-level analysis and assessment of adaptation readiness and does not involve community-based fieldwork. It only reviewed what is available on paper and what can be accessed online. It is therefore imperative to know that the actual implementation of adaptation plans and policies as well as how things happened on the ground might be different and thus the thesis may not be accurate in assessing the ‘real’ climate readiness since there was no field work.
2. The thesis is only about climate change adaptation readiness in relation to communities, fisheries and especially, fishing communities. Readiness in relation to other sectors such as mining, farming, tourism, forestry among others could be different.
3. Some related secondary data was sometimes not available or accessing available usable data was difficult/impossible. One does not know if information could be available in hard copy since the researcher only depended on online data and information. Data collection and sorting was also usually time consuming.

4. Language barrier was another constraint to this thesis. While data was available online, data on some countries were in Spanish (Cuba and Dominican Republic) and French (Haiti). A professional language interpreter was involved but one does not know if explanations from interpreter was robust enough to explain complex issues in this thesis.
5. Giving the constraints of the research methodology, some published literatures may be have been missed.
6. Scores only look at the presence of communities, fisheries and fishing communities in documentations and does not say anything about the quality of adaptation efforts by countries. Therefore, one do not know the true readiness of countries. It is either over-stating readiness or understating it depending on differences in documentation and reality. However, this is a good first step towards a more integrated and comprehensive future research.

Chapter 2: Literature Review

2.1 The Connections between Climate Change Adaptation, Fisheries and Community-Based Participation

2.2 Introduction

The links between climate change adaptation, communities (participation and involvement), and fisheries (including fishing communities) are important for both climate change and development studies disciplines. These key concepts are currently affecting the world and it is apparent they will continue to do so in the future. This chapter review the literature on the concepts - climate change adaptation, fisheries, and community-based participation - and assess their interconnections. It is divided into three main areas of literature: climate change adaptation, the connection between climate change adaptation and community participation (communities) and the connection between climate change adaptation, fisheries and/or fishing communities. It is essential to note that the literature review on community-based management and climate change adaptation linkages only clarifies our understanding of the significance of community's involvement and participation in climate change adaptation and this thesis is not necessarily about on-the-ground community-based participation or management since there was no field research.

From a development perspective, the theoretical framework is the link between climate change and development. From a development perspective, the theoretical framework of this research discusses the concepts of climate change adaptation, fisheries and fishing communities and development. The theoretical framework demonstrates an understanding of how climate change poses a serious threat to lives and livelihoods,

particularly for the world's poorest and most vulnerable populations in fishing communities. The impacts of climate change may reverse improvement towards attaining the Millennium Development Goals especially achieving environmental sustainability (Goal 7). In this sense climate change is both a development and an environmental challenge.

2.3 Climate Change Adaptation

Adaptation and mitigation strategies have emerged as effective management tools for governments, businesses, and communities worldwide. Though mitigation and adaptation are both fundamental approaches to combating climate change impacts (VijayaVenkataRaman et al. 2012), adaptation is more crucial for meeting several environmental and sustainable development objectives than mitigation, especially in developing countries (Adger et al., 2012).

Ordinarily, adaptation to climate change is considered as a reaction to climate alterations that seek to reduce the susceptibility of social and biological systems to current climatic variations and changes (Adger et al., 2005). The European Commission Climate Action defined adaptation to climate change as a means of “anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise” (European Commission, 2015). Adaptation plans and policies are needed to ameliorate the unavoidable impacts of climate change. However, preparations for these plans and policies require decisions based on understanding both current and future climatic changes.

Adaptation has also become an important option for most countries and communities mainly because adaptation actions and options will help improve resilience. However, adaptation is not simply a matter of designing projects or putting together lists of measures to reduce the climate change impacts but should be proactive and attached to a country's agenda for economic growth and development, and also must be incorporated into its poverty reduction approaches (Cole, 2008). These strategies may involve establishing and identifying goals as well as prioritizing actions that can help meet them.

The United Nations Framework Convention on Climate Change (UNFCCC) was therefore set to address adaptation and mitigation. The UNFCCC calls for stabilization of the greenhouse gas (GHGs) emissions in the atmosphere at a level that would avert 'dangerous anthropogenic interference' with the climate system, coupled with a time frame that will allow the environment adapt naturally to climate changes as well as enable economic development proceed in a sustainable manner. In 2001, the Parties to the UNFCCC provided a procedure for greenhouse gas (GHGs) to categorise priority activities that respond to their urgent and instantaneous requirements to adapt to climate change (Parry et al, 2001).

In terms of adaptation, the UNFCCC requests countries to prepare in order to adapt to the adverse effects of climate change. Adaptation is important in order to react to the negative impacts of climate change that are already happening, while at the same time organise for future impacts. The UNFCCC's adaptation plans include the formation of Adaptation Committee and Least Developed Countries Expert Group; employing

adaptation action through National Adaptation Plans (NAPs) and Programmes of Action (NAPA); The Cancun Adaptation Framework among other plans and policies.

The formation of the UNFCCC also necessitated individual countries to come up with policies and programs at governmental and local levels to deal with the problem. By the year 2005, more than 100 countries recognised by the United Nations signed on to the UNFCCC and came out with their First or Initial Climate Change Communications and Action Plans as well as comprehensive Policies to combat the dire situation created by climate change. Individual countries and governments have also taken up special efforts to combat and adapt to climate change.

For example, the United States government has come out with The President's Climate Action Plan to cut carbon pollution, The Great Barrier Reef Climate Change Adaptation Strategy was established by the Australian Government to reduce climate risk to life, property and the natural environment. Besides, there has been several frameworks and policy modifications governed by individual states to cover all aspects of the natural environment such as forestry, water, mining, and fishery. However, engaging or involving communities that are directly and indirectly affected by these policies and plans have been an important factor in the battle against climate risk.

2.4 Climate Change Adaptation and Community-Based Participation Nexus

Community-based participation is a matter on which there are differences between development experts and practitioners. While development experts describe community-based participation as vigorous involvement in the decision making process (Marchington & Wilkinson, 2005), development practitioners term it as not having a significant meaning

unless people are involved and have substantial control over the decisions concerning the organization to which they belong (Kothari & Cooke, 2001).

In contrast, development economists explain participation by the deprived in terms of the equitable allocation of the benefits of projects (McFarlane, 2000). However, others view participation as a tool to enhance the efficacy of projects or as the co-production of services. Some even regard participation as an end in itself, whereas others see it as a means to attain other goals. These diverse viewpoints reflect the modifications in the purpose for which participation might be supported by different groups.

Whereas the arguments go on, for purposes of this review, we aim to define community participation as a dynamic practice by which beneficiary groups or communities influence the trend and implementation of development projects with a view to improving their well-being in terms of income, personal growth, self-reliance or other values they cherish (Tosun, 2000). Firstly, this definition suggests that the framework of participation in development is important – for example in terms of the structures of climate change projects and programs in fishing communities. Community participation in this review is also recognized as a participatory form of governance that provides a supportive environment for involvement at the project level with the focus on the participation of beneficiaries of projects, and not that of government personnel or of donor staff.

The concept of community participation is regularly advocated in policy responses to climate change. This is mainly due to its role in developing major decisions during the planning, development and operational stages of environmental projects and programs (Reed, 2008). A good community involvement platform contributes to the best possible

development and operational decisions (Few, Brown & Tompkins, 2006). That is, community participation and involvement is critical in formulating climate change policies because its implementation cannot be effective without the cooperation and support of people who are affected by it.

Community participation shares several characteristics. The United Nations Development Programme (UNDP) concluded that ‘Adaptation Policy Frameworks’ for the formulation of climate change adaptation strategies should emphasize stakeholder and community engagement at all levels, including ‘grassroots stakeholder participation’ (Wilbanks, 2003). It is important therefore to come to an agreement that the involvement of community significantly increases the effectiveness of climate change policy formulation and implementation. Indeed, Urwin & Jordan, (2008) confirmed that top–down method to climate change adaptation plans and policies have the tendency not to be successful. Community participation could therefore be the solution to the traditional top down approaches to climate change policies.

Two major purposes of community - based participation and involvement are outlined in this review. Firstly, in the broadest logic and in the context of climate change adaptation, community participation may be assumed as a mechanism for empowerment of people to deal and cope with climatic changes (Thomas & Twyman, 2005). According to this interpretation, participation in environmental activities is a way of empowering people in order that they would be able to initiate actions on their own and thus influence the procedures and outcomes of change. Secondly, community participation and involvement may contribute to improved project efficacy in climate change adaptation. Efficacy

advocates the point to which a given objective is accomplished (Zimmerman, 2000). This implies that participation tends to expand the worth of projects since the involvement of communities contribute to better project formulation and implementation. In the perspective of climate change adaptation, community participation may improve project efficiency through planning, implementation and evaluation as well as help in climate risk assessment (Van Aalst, Cannon & Burton, 2008).

Community - based participation is increasingly an important part of environmental disaster management including climate change. It is also considered as a crucial concept in environmental management because it helps to build resilience. As a response to climate change and its effects, preparing for climate change adaptations requires the development of clear policies, as well as the mobilisation of communities to build resilience to extreme weather events (Hobson & Niemeyer, 2011). Community-based climate change action plans are needed in order for communities to take a practical role and control over their vulnerability to climate change and its expected effects (Shackley & Deanwood, 2002). Essentially, communities must be informed not only about the problems associated with the threat of climate change but also be made aware of their participation in developing strategies which play a vital role in finding long term solutions to the problem.

Community-based participation identifies patterns for a type of governance that is inclusive and supports democratic values. As the effects of climate change progressively challenge the headway towards development goals in developing countries, community based participation approaches are needed for organising policy frameworks (Van Aalst, et al 2008). There is therefore the need for community based participation in climate change

adaptation mainly because it incorporates divergent capabilities and welfares of contributing communities in adaptation policies. When communities are allowed to contribute to policies, it brings out different ideas and opinions which enhance policy efficiency. Community – based participation also reinforces the adaptive capabilities at the local level where the impacts of climate change events and environmental stresses are mainly experienced. Proper community-based participation means involvement of people affected by climate change impacts in analysis, decision-making, planning, and programme implementation, as well as evaluation.

2.5 Linking Climate Change Adaptation with Fisheries and/or Fishing Communities

The idea to include fisheries and/or fishing communities in climate change adaptation plans and programs is recognised among governments and relevant stakeholders as crucial especially in developing appropriate strategies and interventions. The fishing industry includes fish, fishery, fishing communities and all fishery related activities. As a major economic sector especially in developing countries, fishing is connected to changes in climatic conditions and considered as one of the most vulnerable sectors to global climate change (Parry et al., 2001; IPCC, 2014).

According to Daw et al., (2009) marine and freshwater fisheries are vulnerable to a wide range of climate change effects. This is because the ecosystem that supports fisheries are sensitive to climate variability and change. The Intergovernmental Panel on Climate Change (2014) outlined various physical risks associated to aquatic and marine systems due to climate change. They are: loss of coastal wetlands, coral bleaching and changes in the distribution, and acidification of oceanic waters. The environmental risks associated

with sea level rise, increasing storm intensity and temperature changes can result in displacing people from their lands and other essential properties which are needed for sustainable livelihoods (Dale, 1997).

In addition, the social side of fisheries may also be affected by climate change. That is sea level rise and other extreme weather such as typhoons and tropical storms will have impacts on fishers, wharfs, fishing communities, and other fishing related industries as well as displacement and migration of human populations. However, fisheries are normally ill-prepared financially and institutionally to take on obligations. These hamper them from refining their livelihoods notwithstanding the government's fishery reforms. While the importance of fisheries is often understated, the implications of climate change impacts for the sector especially for fishing communities are difficult to ignore (Warner et al, 2009).

Climate change impacts on marine ecosystems and associated livelihoods are growing and the reason for this section is to provide a brief overview of the likely impacts and present the details of ongoing and completed adaptation plans, actions and strategies. The next chapter discusses the connections between climate change adaptation and fisheries as well as fishing communities.

2.6 How Ready are Countries and Organisations for Climate Change Adaptation?

Readiness encompasses the state of being fully organised and prepared for something. Adaptation readiness deals with an alternative and complimentary viewpoint to adaptive capacity, capturing real actions that have already been started to prepare for

adaptation and to help inform if and when adaptive capacity will translate to action (Ford & King, 2013). The interest of climate change adaptation readiness is of importance to researchers and policy makers. Over the past years many research institutions and organisations have undertaken studies to adequately measure climate change adaptation readiness for countries, institutions, and societies. These studies were conducted through comprehensive and thorough examinations.

The University of Notre Dame, for example, started an Environmental Change Initiative, focussed on assessing climate resilience, and measuring adaptation readiness to climate change globally through ‘Notre Dame Global Adaptation Index (ND-GAIN)’ project. The project outlined several ways to confront the interconnected problems of “invasive species, land use, and climate change, focusing on their synergistic impacts on water resources” (Notre Dame Global Adaptation Index, 2014). The project defined how vulnerable and sensitive countries are to the stress associated with climate change as well as the adaptive capacity of countries to the challenge of climate change. This readiness index project defined several social-economic and political factors for countries globally.

Another study conducted to ascertain adaptation readiness for countries is the UNFCCC’s Adaptation Fund’s Readiness Programme for Climate Finance. This program aims to help reinforce the capacity of national and regional bodies to receive and manage climate financing, mainly through the Fund's direct access, and to adapt and build resilience to counter changing climate conditions in sectors ranging from agriculture and food security and to coastal zones as well as urban areas (Adaptation Fund, 2014). The Programme also intends to organize leaders and nurture negotiations and collaborations in climate finance readiness.

In addition, governments and relevant stakeholders in both developed and developing countries have concentrated efforts on vulnerability assessment. These assessments are in the form of formulation, implementation and evaluation of policies, strategies and plans and they contribute to supporting adaptation readiness. For example, Bell & Froome, (2012) reviewed climate change adaptation readiness of the Australian national electricity market institutions. This assessment was done to support readiness in Australia's electricity market by assessing the robustness of the institutional arrangements that support effective adaptation plans and policies.

Nevertheless, these readiness research studies and programs have limitations. The Notre Dame Global Adaptation Index (ND-GAIN) project deals with general global adaptation readiness issues, and Adaptation Fund's Readiness Programme for Climate Finance only involves financial readiness. One limitation is that they do not sufficiently or directly deal with communities, fisheries and fishing communities, though these are considered to be very vulnerable to climate impacts – so climate change adaptation readiness in relation to communities, fisheries and specifically, fishing communities is essential for the overall development of many countries especially island developing countries.

Chapter 3: The Caribbean Region

The Caribbean region comprises the Caribbean Sea, its numerous islands - some bounded by the Caribbean Sea and some bordering the Caribbean Sea and the North Atlantic Ocean - and the immediate coasts. The region is southeast of the Gulf of Mexico and the North American mainland, east of Central America, and north of South America. With both tropical and subtropical ecosystems, the region is encompassed by coral reefs, mangroves, forest, grasslands and has a unique wildlife. While these resources are not evenly distributed, the overall richness and the economic importance of the region's ecosystem is undeniable (Ellison & Farnsworth, 1996).



Figure 1: Map of Caribbean countries showing the coastal regions that may be vulnerable to climatic changes. (Green shades show vulnerable island countries in the Caribbean).

With respect to fisheries, The Caribbean region is characterised by long coastlines and few water bodies which support fisheries and fish related activities. Subsistence fishing activities such as traditional artisanal fishing are the main fishing types but are characterised by complexities such as lack of governance structures, inadequate subsidies, fluctuations in stock, growing demand for fish and poverty (Salas et al., 2011). Changes in climate conditions exacerbate these existing problems with extreme weather conditions, rising sea levels, ocean acidification, increasing water temperatures. According to Bueno et al., (2008) the over 20 dozen island nations of the Caribbean, with a population of about 40 million, are in the front lines of climate change vulnerability. This chapter analyses the regions' vulnerability to climate change with explicit attention to fisheries and fishing communities. The chapter also discusses and examines the state of fisheries production and problems associated with the fishery industry.

3.1 Fisheries and Fishing Communities in the Caribbean

Fisheries and fish related activities provide good sources of livelihood and sustenance to the people in the Caribbean. Fishing contributes to food security, employment, foreign exchange earnings, poverty alleviation, development and the stability of rural and coastal communities. Fisheries also contributes to culture, tourism and recreational activities. According to the Caribbean Regional Fisheries Mechanism (CRFM), in 2008, the fishery sector contributed to Gross Domestic Product (GDP) at levels that vary from one country to another, from as low as 1% in most countries to about 6% in Guyana. Marine capture fisheries remain the most dominant method of capture due to the

geography of the region. Masters, (2011) describes the region as typically small island states surrounded by the sea with some of the countries without fresh water bodies.

The FAO (2012a) indicates fishes caught: shrimp, prawns, spiny lobsters, conch, deep slope and bank fish and offshore and coastal pelagic. Other species include spiny lobster mainly in Bahamas, Belize and Jamaica; conch in The Bahamas, Belize, Jamaica and Turks and Caicos Islands; shrimp and prawns in Belize, Guyana, Suriname and Trinidad and Tobago; tuna in most of the Caribbean region. Inland capture contributes very little to the fish yield in Caribbean countries and is limited to the bigger territories of Belize, Guyana and Jamaica. Most fishes caught from this method are tilapia.

The Caribbean fisheries industry is challenged in many ways. According to the Caribbean Regional Fisheries Mechanism CRFM, the challenges include overexploitation of commercially imported species, illegal and unreported and unregulated fishing (IUU), inadequate delimitation of the Exclusive Economic Zone (EEZ), lack of capacity to formulate and implement appropriate fishing sector policy and inadequate management of fishing stocks. Climate change has also been identified as a devastating environmental problem faced by the fishing sector (Bueno et al., 2008; Scott et al., 2008).

In order to achieve the Millennium Development Goal (MDG) of hunger and malnutrition eradication there is the need to improve fish management because two thirds of world fisheries has been depleted due to unsustainable fisheries practices and overfishing identified as a global concern in many parts of the developing world (East- Asia and the Pacific Islands). (Heck, et al., 2007; Gill, et al. 2003; Allison et al. 2006). In Jamaica, while the assessment for the period 1996 – 2000 indicates no evidence of overfishing or collapse

of fisheries species, there was caution on expansion which may result into collapse (Galbraith & Ehrhardt, 1999; Ehrhardt, & Shepherd, 2001). Further, there has been reports of overfishing in Guyana and Suriname most dominant fishing countries in the Caribbean region (Ehrhardt, & Shepherd, 2001).

Secondly, illegal and unreported as well as unregulated fishing (IUU) has been reported as one of the main challenges to effective and efficient fisheries management. This includes activities that contravene the national and international rules and regulations for fishing. Reducing IUU enhances conservation of marine and aquatic ecosystems (Global Ocean Commission, 2013). From the global perspective, IUU takes diverse forms in nationally controlled waters and on high seas and it is not known how much IUU fishing takes place worldwide (Gallic & Cox, 2006) Fishing activities that have not been reported are considered illegal in some countries and managing fisheries poses problems if managers do not understand or know the full extent of catches (Tsamenyi et al., 2009).

The challenges of fighting IUU according to the Caribbean Regional Fisheries Mechanism, 2013 reports are that IUU fishing is a high source of undeclared money/income; the fight against IUU fishing is a high risk; some EEZs are not clearly delimited making enforcement more difficult; inadequate capacity of individual countries to monitor fishing zones.

Furthermore, there is lack of capacity to formulate and implement appropriate fishing sector policy and inadequate management of fishing stocks in the Caribbean region. The primary objective of fisheries policies is to introduce fundamental shifts and changes in government and peoples approach to the fishing industry (Grafton et al., 2006; Hilborn,

2007). It involves adopting a development based approach that is integrated into fishing communities to be able to sustainably manage. Sector policies will also give fishers the formal and legal recognition and protection through fishery rights.

In the Caribbean, most countries lack the capacity to sustainably formulate and manage fisheries and other marine resources due to several factors ranging from inadequate financial assistance and lack of experts in fisheries management (Salas, et al. 2007). Another threatening challenge to the region's fishing industry and fishers in general is the impact and problems associated with climate change.

Changes in climatic conditions cause oceans to become more acidic, the level of the sea to increase at unprecedented rates, and the temperature of the ocean may change; these impact greatly on marine resources (Bindoff, et al., 2007; Le Quéré et al., 2008). Additional impacts may be the destruction of fish habitats due to fisheries migration, some fish species will go extinct, the marine food chain will be destroyed, rising sea levels will cover wetlands, worsening weather may stop fisher folks going to the sea and this in the long run will affect fish trade (Rijnsdorp et al., 2009). Subsequent sections of this chapter expand and critically examine the sensitivity of the region to climate impacts.

3.2 Fisheries Sensitivity to Climate Change Impacts in the Caribbean

Several climatic disasters have occurred in the region over the years. For instance, Hurricane Earl, a powerful tropical cyclone, impacted the coast of many Caribbean countries, such as the Bahamas, Saint Kitts and Nevis, and Antigua and Barbuda among others. According to the National Oceanic and Atmospheric Administration (NOAA), in September 2010, Hurricane Earl destroyed several communities and wharfs as well as local

fishing equipment and fishing points. The severity of this hurricane changed the dynamics of most coastal ecosystems and coral reefs including the physical coastline of affected countries which are very important for fisheries productivity and tourism (Payet & Agricole, 2006).

Caribbean regions' sensitivity to climate change is summarised as follows: expected increase in temperatures; reduction of rainfall; increased flooding in the wet season and increased drought conditions in the dry season; changes in hurricane frequency as well as sea level rise of about 5 mm per year projected for the next 100 years (Mahon, 2002). It is important to note that due to the geography of the region – mostly scattered among mainland and South and Central America – there are variations in how the region will be directly and indirectly affected by climatic and environmental changes. Badjeck et al (2010) explained the expected impacts of climate change on fisheries and this explanation was used to examine the Caribbean countries' state of climate change effects and impacts.

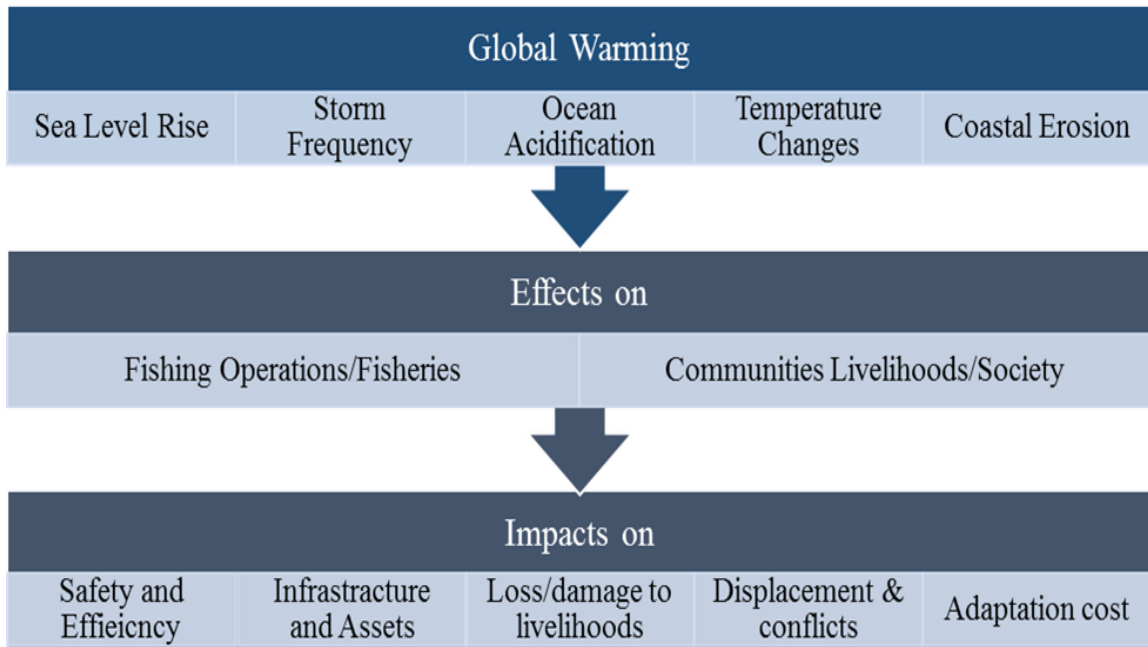


Figure. 2: Summary of climate change impact on fisheries (Badjeck et al, 2010)

To start with, IPCC (2011) predicts an increase of 0.11m to 0.88m in sea level by 2100 (Church et al., 2013). Similar projections based on the use of General Circulation Models (GCMs) for the end of the 21st century range from 0.18 to 0.59 m in sea level rise (Mcleod et al., 2010). For instance, for the past years melting of ice in Greenland has added a significant amount to the sea (McGrath et al, 2013). The result of sea level rise may cause migration of fish and other marine resources (Schwartz & Randall, 2003). These changes are expected to modify the distribution and productivity of marine and freshwater species; the consequences are highly uncertain. Fishing infrastructure such as landing points and wharfs will be affected. In relation to the Caribbean, since most of the regions' fishery infrastructure is found along the coast, sea level rise may be inevitable and detrimental.

In addition, the region is expected to experience increased temperatures. Temperature changes will impact fisheries habitat and fish stock distribution. Temperature

increases will also affect water quality which has the potential to influence the availability of fish habitat (Mohseni et al., 2003). Fish habitats are already under pressure and temperature changes poses serious risk to the long term viability of local fish stocks (Roessig et al.2004). In the Caribbean, most of the species exploited occur in the northern and the southern regions therefore the general distribution are not expected to affect the region's fisheries (Mahon, 2002) but there is the need to examine species in order to determine potential changes to local fish species. Once there is a slight change in distribution, it normally affects fish stock availability. That is, how much fish is caught by fishers can be affected by changes in temperature as a result of weather and climate (Mahon, 2002).

Ocean acidification and climate change are inseparable due to the fact that climate changes are induced by humans and once there is intense exposure of the sea due to temperatures changes there is the tendency of carbon dioxide to react with the sea to make it more acidic (Doney et al., 2009). For instance, sea snails which serve as food for salmon in the North Pacific Ocean are in danger due to ocean acidification (Fabry et al., 2008). According to the WWF (2010) report, humans have put as much carbon into the atmosphere that the ocean has become about 30% more acidic. This changes the biological and chemical processes of the sea. Oysters, snails and lobsters according to research may struggle to mature because acidification reduces ocean calcium and these creatures need calcium to grow, acidification also reduces fish sense of smell making them very vulnerable to predators and it also causes respiratory acidosis in fishes. However, minimal research on the specific impacts of ocean acidification in the Caribbean has not been undertaken to date.

In addition to the above disasters, increased flooding in the wet season and increased drought conditions in the dry season affect fish distribution, fish recruitment and habitat due to the increase or decrease in volume of water (Pearsons et al. 1992). Capture fisheries are affected by changes in the volume of rivers, lakes and the ocean. Rising water levels will cause coastal erosion and flooding of coastal areas and these may dislodge coastal fishing settlements and coastal infrastructure such as wharfs as well as ocean dynamics (Hartt, 2011). Coastal mangroves which serve as breeding grounds for a large variety of fish species may be destroyed due to increase and decrease in water levels.

Besides climate change, fisheries in the Caribbean may be susceptible to other factors such as over fishing, bottom trawling, per trolling, light fishing due to poor fisheries management, lack of implementation enforcement of rules and regulations.

3.3 Programs, Projects and Policies to Adapt to Climate Change Impacts in the Caribbean

Facing the numerous negative effects of climate change outlined above, there have been policies and institutional responses to impacts of climate change globally. From the 1970s, the first world climate conference was held to dialogue on the impacts of climate change. In addition, by the early 1990s, the first Intergovernmental Panel on Climate change (IPCC) assessment report was published and circulated. The formation of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 was also a significant response to severe climatic changes.

In the Caribbean region, several plans, programs, and projects have been undertaken to adapt to severe weather and climatic conditions. For instance, countries in the Caribbean have formulated policy frameworks for integrated adaptation, planning and management. These policy frameworks include vulnerability assessment, adaptation projects and country strategies, among others. In 1997, the Caribbean Planning for Adaptation to Global Climate Change (CPACC) Project was introduced. The CPACC project was the first major initiative to support CARICOM regions to adapt to global climate change in coastal communities. The project supported vulnerability assessment, enhanced strategies to adapt, and also built capacity of coastal communities to the impacts of climate change (Mahon, 2002).

Additionally, the Mainstreaming Adaptation to Climate Change (MACC) project was designed to consolidate and build resilience in small island developing Countries and low-lying coastal states. One important component of the MACC was to mainstream climate change into sustainable development planning for sectors such as fisheries, tourism agriculture and water (Tompkins & Adger, 2005; Burton & Aalst, 1999; Belle & Bramwell, 2005).

In 2001, the World Bank in collaboration with CARICOM, created 'Adapting to Climate Change in the Caribbean' (ACCC) project funded through CIDA. This project was mainly imperative for the region to build resilience to climate change. ACCC's main objective was to shape institutions and individual's capacity in adaptation. The project lasted for three years and effectively sustained CPACC activities and built further capacity for climate change adaptation through the transformation of projects. It also provided

resources for the financial sustainability of other related projects. However, while independent components of ACCC were successful, there were conflicts with the financial institutions. Therefore, due to exchange rate meltdown, funds were held back. This delayed the conclusion of several components of the project and efforts were rather devoted to negotiation and management.

For fish and fisheries, the MACC project according to Mahon (2002), “will assist the countries of the Caribbean in identifying and formulating measures that would enable the fisheries sector to develop appropriate adaptation measures to address impacts on fishing communities, fisheries resources, and associated ecosystems such as coral reefs”.

Besides projects, policy options were also adopted by governments and relevant organisations to adapt to climate change in fishing communities and fisheries. Stakeholder consultations, trainings and consultancies has been an integral part of governments in the Caribbean to strengthen national fisheries administrations in order to minimise the harmful effects of climate change in the CARICOM fisheries sector. Caribbean countries are at various stages of preparing, developing and implementing climate change adaptation policies. Most policies are dependent on the nature of the impacts as well as future and current vulnerability. Several countries in the Caribbean have submitted information on adaptation plans in the First and Second National Communications. This is required to identify prioritised activities and policies that will help respond to immediate needs to adapt (Hardee & Mutunga, 2010).

Further, Caribbean countries have implemented various national climate change policy documents which have outlined impacts and vulnerabilities. For instance, the

Jamaican government has developed national strategies and action plans for climate change adaptation. Similarly, in the Bahamas, several policy measures and frameworks have been put in place. Typically examples are the Bahamas National Climate Change Policy, Bahamas National Act, Conservation and Protection of Physical Landscape Act, Fisheries Act, Disasters Response Act, among others (BEST Committee, 2001).

These plans, projects, policies among others have been very widespread and rigorous in most island countries in the Caribbean. However, it is very significant to evaluate if communities, fisheries, and specifically, fishing communities have been well represented in policy documents in various island countries. This evaluation of Caribbean countries will help assess the readiness levels of this all important sector (fisheries sector) to the inevitable effects of climate variability and change.

3.4 Vulnerability of the Caribbean Small Island Developing States (SIDS) to Climate Change

According to the IPCC, (2014) “vulnerability to climate change is the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change”. Vulnerability may be in the form of economic, social, and environmental. For instance, low-lying islands or coastal cities; fishing communities; fisheries; ecosystems, are most vulnerable in the Caribbean and this may impede economic growth, social development and environmental restoration. Small Island Developing States (SIDS) in the Caribbean have therefore been recognized by the

international community as a distinctive case of climate change vulnerability whose needs and concerns have to be addressed (Mavrogenis et al. 2014).

Though these countries are among the least liable or responsible for climate change, they are expected to suffer most from its negative effects. In some cases, SIDS in the Caribbean may even become uninhabitable (Jaja & Dawson, 2014). These make the region a special case requiring the help and attention at different levels including international and national community levels; governmental and non-governmental organisational levels. In assessing the vulnerability of countries in the Caribbean, this research draw upon two vital literatures which critically assessed both human and biophysical vulnerabilities.

Firstly, the University of Notre Dame's Environmental Change Initiative, Notre Dame Global Adaptation Index (ND-GAIN) prepared a global vulnerability assessment of the levels vulnerable countries to the negative impacts of climate change. The assessment measured country's exposure, sensitivity and capacity to adapt to climate change. Though, the methodology used by this project is generic and simplistic, it portrays and shows certain importance in the form of which countries are more exposed based on values and figures generated by their research. The graph below shows the vulnerability values of selected countries in the Caribbean by Global Adaptation Index (ND-GAIN). These values are based only on the Global Adaptation Index (ND-GAIN) assessment of vulnerability. Their results indicated that Haiti, St Vincent and the Grenadines, and the Dominican Republic are highly vulnerable relative to the Caribbean SIDS. Barbados, Antigua and Barbuda and Bahamas are least vulnerable in the region. Their result is indicated on the graph below:

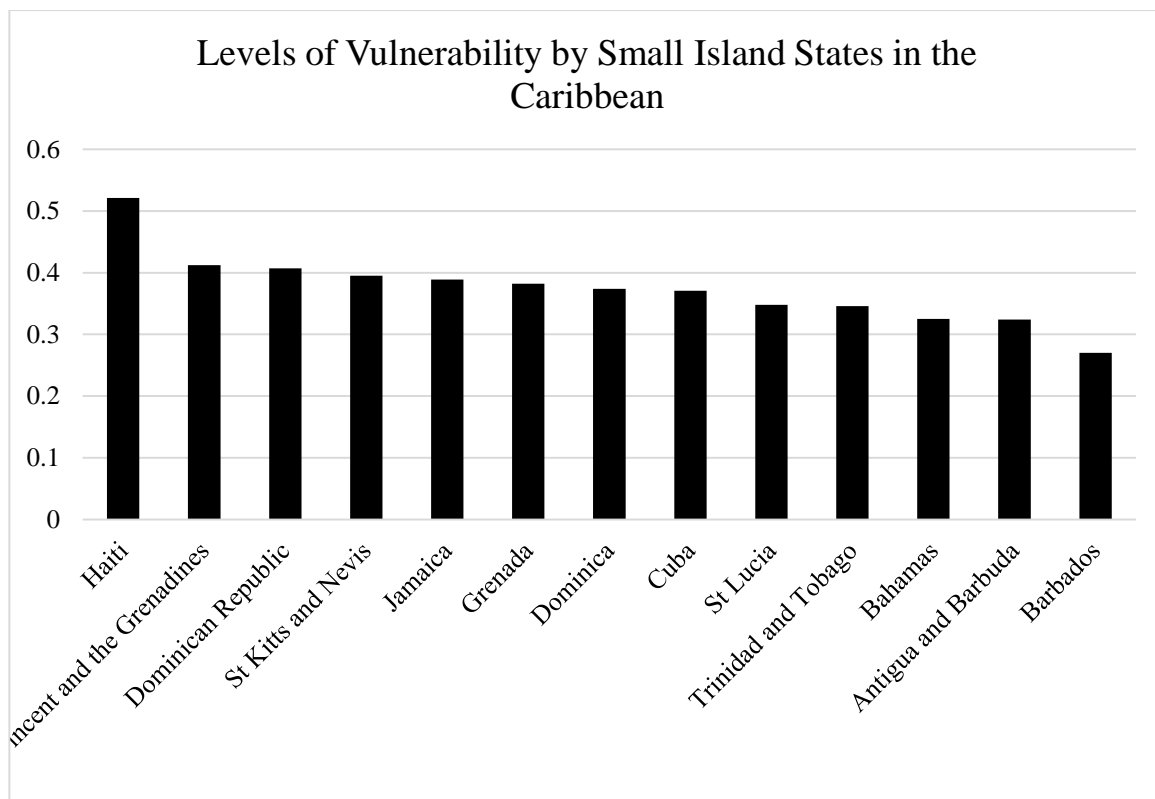


Figure 3: Levels of Vulnerability of Small Island Developing Countries in the Caribbean
(Source: Notre Dame Global Adaptation, 2014)

To augment the study by Notre Dame Global Adaptation, this research also considered the vulnerability of national economies to the impacts of climate change on fisheries by Allison et al., (2008) which compare and assess the vulnerability of 132 national economies to potential climate change impacts on their capture fisheries. This study was chosen because it assess fisheries and fish related activities which is key to this research. Their findings show how fisheries and fish related activities are vulnerable to the negative impacts climate change. In addition, a wider international evaluation highlighted the particular vulnerability to climate change of small island states such as those of the Caribbean. In their study, they concluded that Haiti and the Dominican Republic are most

vulnerable among the Caribbean SIDS, however, most countries in the Caribbean though vulnerably are not among the first 30 most vulnerable countries that were considered in their study. These results were compared to the overall readiness in the discussion section of this research.

Chapter 4: Research Methodology

4.1 Methodological steps and data collection

Data on adaptation plans and projects were recorded on thirteen (13) island countries in the Caribbean. The countries were selected based on their United Nations (UN) membership. They are Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines and Trinidad and Tobago. Overseas island territories in the Caribbean e.g. Cayman Island, Anguilla, British Virgin Island, Montserrat were not included in this study since they are not classified as countries by the UN system.

This study further used data primarily from secondary sources in developing, determining and evaluating the levels of adaptation readiness in relation to communities, fisheries and/or fishing communities. Secondary data were also gathered and compiled from primary and grey literature mostly from government websites of countries relevant to this study as well as various websites essential for this study. In addition, data were extracted from publications of intergovernmental organisations as well as multilateral agencies. These organisations and agencies include Caribbean Community Climate Change Centre (CCCCC), Caribbean Regional Fisheries Mechanism (CRFM), CARIBSAVE, Food and Agriculture (FAO), Caribbean Natural Resources Institute (CNRI), Inter-American Development Bank.

Three common but important databases were extensively explored for the peer reviewed resources and other important documents. They are Google Web Search, Google Scholar and ISI Web of Science. Other sources of information on adaptation plans include

consulting relevant government database in the Caribbean, Inter-Governmental Panel on Climate Change (IPCC) reports, United Nation Framework Convention on Climate Change (UNFCCC)'s National Adaptation Programmes of Action (NAPA) and United Nations Convention to Combat Desertification (UNCCD)'s National Action Programmes (NAPs). National Adaptation Plans (NAPs) of Small Island Developing States (SIDS), UNFCCC's National Communications, Climate Change Adaptation and Disaster Risk Management.

4.2 Methodological Modeling

The review of existing information from the above sources led to the selection of Ford and King (2013) adaptation framework to determine adaptation readiness levels. The framework includes factors that encourage governments, funding organisations and stakeholders to act on climate change adaptation, vulnerability assessment, action plans as well as policy strategies for effective adaptation. These factors have been combined into an “architecture for adaptation” which helps governments and decision makers to plan efficiently for adaptation (Smith et al., 2009; Ford and King, 2013). Building upon these verifiable cases of adaptation and to find out whether adaptation incorporates communities, fisheries and/or fishing communities, six significant factors were established from Ford and King's (2013) framework.

They include Political Leadership on Adaptation, Institutional Organisation for Adaptation, Adaptation Decision Making and Stakeholder Involvement, Climate Change information and Research, Science and Technology for Adaptation in addition to Funding for Adaptation Planning and Evaluation (See Figure 4 below):

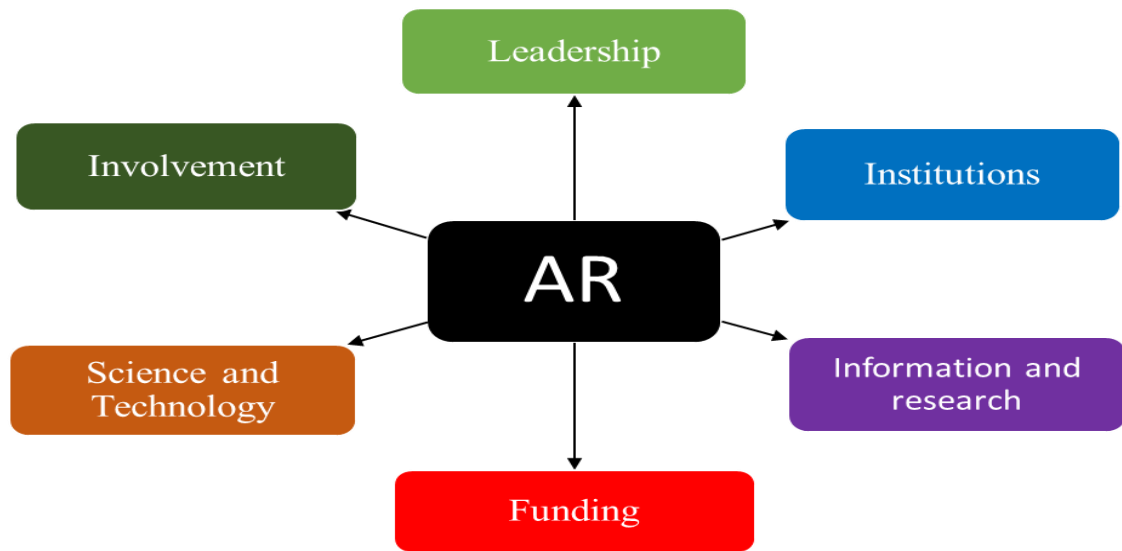


Figure 4: Adaptation Readiness Framework and Model (Ford and King, 2013).

Twenty-one (21) essential indicators assumed to collectively contribute to the measure of Ford and King’s six adaptation readiness components were selected. Additional indicators may add to the criteria but were not included due to lack of information or perceived difficulty in assessment. The breakdown of the six components and their 21 indicators are outlined in Table 1 and discussed in details in the next section of this chapter.

Table 1: Components and their indicators

Component	Indicators
Political leadership on adaptation	1. National strategy paper/policy
	2. UNFCCC communications
	3. National acts and legal frameworks
	4. Signatories to climate change conventions and protocols
Institutional organisation for adaptation	5. Lead Ministry/Department/Agency/unit
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc
	7. Inter-Agency & Cross Sectorial Partnerships
	8. Climate Change Mainstreaming Initiatives
Adaptation decision making and stakeholder involvement	9. Non-State Actors Involvement and Participation (Fisheries and Community involvement).
	10. Public Engagement (Town Hall Meetings), Consultations.
	11. Education and Awareness, Curriculum Dev.
Climate change information and research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions
	14. Scientific Agency/National Assessments (NAPAs/NAPs)
Funding for adaptation planning and evaluation	15. Climate Change And Adaptation Funds
	16. National Budgets (Sectorial Contributions)
	17. Private Sector Contributions (Co-Funding, PPP, Green Leasing.)
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral
Availability of science and technology to inform adaptation	19. Early Warning Tools And Technologies
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)
	21. National Technology Needs Assessment Reports

The analytical framework by Ford and King (2013) have alternatives that are equally significant in tracking and measuring adaptation. For example, the Tracking Adaptation and Measuring Development (TAMD) framework used by the International Institute for Environment and Development (IIED) directly track adaptation and measure the impact of climate change on development. The University of Notre Dame's Environmental Change Initiative focussed on assessing vulnerability, resilience, and measuring adaptation readiness to climate change globally through the use of 'Notre Dame Global Adaptation Index (ND-GAIN)' framework, This framework to measured countries exposure, sensitivity and capacity to adapt to the negative effects of climate change.

Adaptation Fund's Readiness Programme for Climate Finance which aims to support and reinforce the capacity of national and regional bodies to receive and manage climate financing, mainly through the Fund's direct access, and to adapt and build resilience to counter changing climate conditions in sectors ranging from agriculture and food security and to coastal zones as well as urban areas (Adaptation Fund, 2014) is yet another initiative that used similar readiness framework. This programme used the framework for Climate Finance to assess readiness. However, the framework was more focussed of financial components of readiness of countries rather than the readiness.

The multi criteria analysis, an environmental decision making technique employ the weighted linear average algorithm including the Analytic Hierarchy Process (AHP) which recognises that the final decision or ranking of options depends on the choice of performance scoring scales, even when the criteria weights are held constant (De Brucker et al, 2013). The multi criteria analysis is another alternative for Ford and King (2013)

framework. However, it is hard to analyze changes involved in this decision making technique, especially in times with so several uncertainties presented by environmental considerations. It has also been overused and lacks the comprehensive and complex systemic features of when interrelated economies are involved.

These other readiness frameworks did not have the required governance indicators suitable for tracking governmental level adaptation initiatives for communities, fisheries and fishing communities. They are too broad and lack the necessary indicators for specific adaptation tracking among communities. Ford and King (2013) was therefore chosen among these tracking alternatives because it uses specific governance criteria which is interconnected and related to this research. It is focussed on what is actually being done to plan and prepare for adaptation, it examines readiness at multiple scales, identify potential indicators and relevant data sources.

The framework by Ford and King in totality brings together diverse conceptual and methodological scholarship necessary for adaptation planning and preparation. Within the each category of Ford and King (2013) are other indicators that make up the various components. These indicators were augmented by other relevant indicators which were selected based on literature search for adaptation (see specific description of indicators in subsequent sections of the methodology). At a regional scale however, the readiness framework can offer a decision support tool for assessing progress in preparing for adaptation and strategically identifying future adaptation needs.

However, Ford and King's analytical framework is generic and lacks socio-cultural aspects of adaptation in communities and fishing communities. The main critique of Ford

and King is model is very broad and is anticipated to assess readiness with regards to only planned adaptation by governments at various scales. The framework emphasized only approximations of overarching factors affecting readiness, and is based on early involvements on what factors are necessary for adaptation to take place and without which adaptation is unlikely to occur. Also, “temporal dimensions and dynamics, cross-scale issues, and relative importance of factors are not captured, though certainly merit the focus of future work.” (Ford and King, 2013).

4.3. Components for Adaptation Readiness Evaluation and their Indicators

4.3.1 Political Leadership for Adaptation

Building good governance institutions are important for nations and organisation to be successful. Recently it has been debated that, governments and institutional reforms with strong public institutions have been result oriented because of their strong accountable and effective political systems (Weiss, 2000; Santiso, 2001). Adaptation is considered as a complex problem and remains highly politicised, therefore good political governance is crucial (Adger et al. 2009, Smith et al. 2011, Ford & King, 2013).

Political leadership was measured based on a country’s national climate change strategy documents, climate change acts, policy frameworks, UNFCCC communications, UNFCCC NAPA/NAPs as well as signatories to climate change conventions. This is because, national development policy and climate change adaptation has been the central agenda for most governments and stakeholders therefore measuring the degree of political

leadership gives a good overview of adaptation preparedness (Giddens, 2009). Four main indicators were assessed for this component they are explained below:

Indicators of political leadership for adaptation:

1. *National Strategy Paper/Policy*: for the purpose of this research, special consideration was given to how communities, fisheries and fishing communities are involved or represented in national strategy papers and related policy documents. National adaptation policies on climate change, climate change strategy papers as well as national disaster plans were assessed. This is mainly because national development policy and climate change adaptation has been the fundamental agenda for most governments and stakeholders (Metz, 2001). Also, before adaptation can be effective there is the need for governments and stakeholders to have standard procedures in the form of policy documents that are necessary for adaptation. For instance, Article 4.9 of the United Nations Framework Convention for Climate Change (UNFCCC) recognises specific needs and special situations for developing countries in form of strategies and policies for them to adapt to changing climate.
2. *UNFCCC National Communications*: I evaluated the UNFCCC's communications based on the existence of initial and second UNFCCC's communication. This communications show an in-depth review conducted by international team of experts and coordinated by the UNFCCC secretariat. The main objective of the national communications is to strengthen the information base and institutional capacity of countries in order for climate change adaptation

and mitigation (Schipper, 2006). According to the World Bank report (2013), in order to integrate climate change priorities into development strategies there is the need for national communications to serve as a rubric for measuring adaptation funds. Also, it is important for fisheries and communities representations in the communications so as to adequately evaluate governments and relevant stakeholder's participation and to assess the risk so as to prepare plans and strategies to address them.

3. *National Acts and Legal Frameworks (Fisheries and Community involvement):*

this indicator was measured based on the availability of national acts and legal frameworks on climate change, fishery and community participation. It has been debated that most countries do not have adequate adaptations plans because there has not been laws and legislations on climate change (Moser & Ekstrom, 2010). Even though governments in developed countries have taken a number of steps to limit their greenhouse emissions through legally binding targets, the story has been different in most developing countries. The United Kingdom for instance has passed the Climate Change Act in 2008 and established a framework to develop emission reduction path (Government of the United Kingdom, 2010). This has justified the use of laws and frameworks to adapt to changing climate in the Caribbean since laws will provide adequate protection of lives and properties and maintain the status quo in the midst of changing climate (Sunstein, 2002).

4. *Signatories to Climate Change Conventions and Protocols:* Just as laws and frameworks are relevant to protect properties and to set rules and regulations for adaptation, signatories to climate change conventions are an important indicator

of a countries' commitment (Protocol, 1997). Adopted in 1992 at the United Nations Headquarters in New York in accordance with Article 20, signatories were opened in Rio de Janeiro. It is said to be the largest multilateral environmental agreement in the world indicating a universal agreement that the problem of climate change exist and there is the need for action (UNFCCC, 2010). These signatories were augmented by the Kyoto protocol which has 192 signatories. The signatories were considered, even though not related to fishery or community, because of their relevance to assess a country's commitment

4.3.2 Institutional Organization for Adaptation

There have been several institutional arrangements for implementing adaptation plans in different countries. These institutions provide the necessary political and administrative systems that can enable or restrict the level of adaptation (Agrawal, 2010). Institutional organisation for adaptation provides an efficient and effective government institutions which will aid adaptation planning and policy. The institutional capacity of countries were reviewed based on the number of ministries, departments, agencies and units (Adger, 2010) responsible for climate change adaptation, fisheries and community participation. Detailed attention was also given to local infrastructure for community, working groups, community taskforce and inter-agency and cross sectorial partnerships for fisheries and community involvement. These are the variables that are discussed below:

Indicators of Institutional Organization for Adaptation

5. *Lead Ministry/Department/Agency/unit*: the existence of ministries and department as well as agencies and units that help in organisation and formulation of agenda and activities to adapt to climate change, disaster risk reduction and management were evaluated. Ragasa et al., (2013) agreed that, opportunities must be provided for institutions and organisations for human capacity strengthening in the midst of changing climate. These institutions include ministries responsible for environment and climate change, fisheries units, community unit committees, climate change agencies and units are important to strengthen capacities and abilities. Also, in order to integrate climate change adaptation plans, projects and policies into national budgetary processes and national planning, there is the need for institutions to man the affairs of adaptation planning and monitoring.
6. *Climate Change Committee/Working Group / Task Force/Ad Hoc*: As part of decentralising institutional organisations for adaptation, the provision of climate committees, units, working groups are important attributes. Most working groups are established to enhance large scale and cooperative efforts to address the challenge of climate change (Change, 2007). Climate committees also aim at improving resilience to local fishing communities whose livelihoods depend on fisheries and its related activities, and it helps in encouraging awareness and collaborations. In the Caribbean, the establishment of the Caribbean Disaster Emergency Management Agency (CDEMA) has seen the emergence of many project steering committees which comprise of representatives that are at the forefront of disaster management and climate adaptation and the provide technical guidance and support for climate change projects and polices

(Collymore, 2011). The Caribbean Community Centre for Climate Change (CCCCC) and the Caribbean Regional Fisheries Mechanism (CRFM) have also provided several working groups and task force to enhance local participation between climate change and fisheries. It is therefore necessary to assess these working groups because it provides the sense of participation.

7. *Inter-Agency & Cross Sectorial Partnerships:* Another important institutional organisation indicator is how various institutions are interrelated. Cross sectorial and inter agency partnerships have been a necessary element for adaptation. I evaluated climate change action programs in the Caribbean. This is because partnerships lead to technical expertise advice, financial assistance, capacity building opportunities and international exposure (Kelman, & West, 2009). They also have programs that provide opportunities for understanding the role of partnerships and inter agency linkages to reduce vulnerability.
8. *Climate Change Mainstreaming Initiatives:* Adaptation mainstreaming is assessed based on existence of these ingenuities in adaptation plans and policies. The impact of climate change is likely to undermine development outcomes (Banuri, 2009) with significant challenges to sustainable livelihoods in coastal and fishing communities (Allison & Ellis, 2001). In order to address these challenges, there is the need for planning responses in form of a major policy agenda. Mainstreaming initiatives have provided the ability to increase the understanding of climate related challenges and plan towards its sustainability. I therefore assessed countries based on how these initiatives are fisheries, community and fishing community focused.

4.3.3 Adaptation Decision Making and Stakeholder Involvement

Public awareness and perceptions of the risk of climate change play a significant role in adaptation decision making because it influences the initiation and development of programs as well as builds institutional capacities (Sampei & Aoyagi-Usui, 2009). Decision making and participation in the context of climate uncertainties is relevant due to the ‘hidden hazard’ nature of problems and these pose major problems to climate action. Due to these barriers, several decision making frameworks and stakeholder modes have emerged. For instance the informative participation and consultative participation methods have seen local communities contribute their expertise to policy making as well as decisional participation (Green & Hunton-Clarke, 2003).

The component is necessary to evaluate because it unearths how communities are represented. The private sector, civil society and the general public are very much involved in climate change planning and development. A number of frameworks in stakeholder engagement have evolved based on these needs and has helped communities in trusting and forming cooperation which is important for adaptation. Three major indicators were assessed and discussed below:

Indicators of stakeholder involvement

9. *Non-State Actors Involvement and Participation:* the roles played by non-state actors over the past decades in environmental and climate change negotiations and awareness creation were critically examined. One important way to measure stakeholder involvement, decision making and participation of climate change policies is to assess how non-state actors are involved. Two main kinds of

involvement were identified: those that include private and voluntary interest groups and communities of expert most at times scientists. These groups help in negotiations, deliberations and documentations for climate change adaptation (Newell, 2006). Assessment was therefore based on the existence of these groups.

10. *Public Engagement (Town Hall Meetings, Consultations)*; Public engagement as well is regarded as one of the most important steps in integrating community agenda and climate change planning (Few, Brown, & Tompkins, 2007). Various countries' involvement based on the existence of town hall meetings, consultations and awareness creation to sensitise the public on the effects of climate change were measured. Involving the public and stakeholders promotes policy response to climate change which is crucial to the overall attainment of policy goals and objectives (Van Aalst, Cannon & Burton, 2008). Public engagement enhances capacity building, identifying opportunities to build capacities which are important in adaptation decision making. It is important to measure because, it gives communities roles to play in emissions reduction, clarifies the role of governments and relevant stakeholders as well as developing resilience towards the harmful effects of climate change.

11. *Education and Awareness*: It is important to understand that, education and awareness creation is an essential role in responding to change (Cordero, Todd & Abellerra, 2008). It helps people to understand and to address the effects and impacts of climate change through attitudinal change. For instance, UNESCO has introduced climate education and awareness creation in their agenda and have outlined various plans to strengthen the capacity of member states and to provide

climate change education for sustainable development and to enhance innovative teaching and learning approaches for climate change mainstreaming (UNESCO, 2010). Besides, governments and stakeholders have adopted interdisciplinary practices which are important for education and awareness in fishing communities. It is therefore an important indicator to measure and its measurement is based on the number of research institutions (both internal and external), curricula change, and educational engagements among others.

4.3.4 Availability of Climate Change Information and Research

Moss et al. (2010) agree that, climate adaptation research is important to inform action and for implications for policy and project implementation. There has been several debates on adaptation research and usable science. Whiles some climate scientists argue about the need for climate change projections through science and research, others think it has been overstated (Ding, et al, 2001). Also, in most countries many research institutions have been established to augment adaptation and to provide the necessary tools for understanding the needs of society, to be able to identify adaption options and to help understand how adaptation can be promoted, implemented, monitored and evaluated. In this assessment, I measured the relevance of researches based on three attributes. They are: the number of institutions, knowledge on adaptation hotspots, and the existence of scientific agency. The specific elements for these attributes are explained below:

Indicators for climate change information

12. Research Institutions (National Academies/Universities/Think Tanks/NGOs):

This indicator assessed the success of research institutions and facilities in the

region. That is the number of researches and whether they have elements of community, fishery and fishing community. Climate researches help to address key questions on the impacts and consequences of climate change in fishing communities (Meehl et al., 2007). Researches from national academies and universities help answer central questions of regional implications of climate change and suggest efforts to eliminate them.

13. *Knowledge on Vulnerability Hotspots/Hazards/Regions*: One way to understand and easily communicate climate change information is by mapping risky and vulnerable areas because it describes the current and future climate change hotspots (Midgley et al, 2002). Hotspots also help in highlighting climate trends and projections but it is important to note that mapping could be a difficult task due to the nature of climate related changes. According to Brody et al., (2008) spatial analysis with strong visual elements depicting climate vulnerable hotspots can help to communicate issues and are easy to interpret. I measured this indicator based on information on the existence of researched knowledge on vulnerable hotspots in their documents.

14. *Scientific Agency/National Assessments (NAPAs/NAPs)*: The United Nations Convention to Combat Desertification (UNCCD) and The United Nations Framework Convention on Climate Change (UNFCCC) have introduced National Adaptation Programmes (NAP) National Adaptation Plans of Action (NAPA) respectively to enable developing countries formulate and implement national adaptation plans for long term adaptation needs. These plans and actions has been on the agenda of most countries in the developing world that are faced

with sea level rise and coastal erosion. This is relevant to measure because it assesses country preparations toward long term adaptation plans and a synergistic approach by NAPs and NAPAs. This attribute was measured through literature search on NAPs and NAPAs. Deliberation was done on whether communities and fisheries were represented.

4.3.5 Funding for Adaptation Planning, Implementation and Evaluation

Different funding types are required for adaptation to be operative. Funding concerns the capital cost of adaptation interventions as well as human resources that are important for the smooth implementation, maintenance and monitoring of adaptation activities and their associated barriers (Bouwer & Aerts, 2006). Since government funding is mostly insufficient considering the rate and cost of extreme weather events, there is the need for specific dedicated adaptation funding. It is accepted that funding needs to be integrated into baseline funding type for it to be effective and efficient (Bals & Butzengeiger, 2006). In most developing countries, funding comes from national budgets, private sector contributions, foundations and international funding resources like the Adaptation Fund under Kyoto Protocol, and the GEF Special Climate Change Fund etc. This component measures the existence of these funding avenues.

Indicators for Adaptation Funding

15. *Climate change adaptation funds*: In recognition of the impacts of climate change in developing and least developed countries, developed nations proposed up to US\$100 billion per year funds for mitigation and adaptation (Stern, 2008). Due to the complex nature of accessing this fund there is a need for governments and

stakeholders to have their own funding initiatives. Countries have come up with national budgets as well as internally generated funds for adaptation. This indicator measured the amount of adaptation funding obtained by countries and provide a checklist for accessibility to fishing communities in the Caribbean. It also focused on the different types of funds available for countries.

16. *National budgets for climate change*: Little attention has been given to climate change financing in most developing countries. Also, most climate budgets are treated as technical issues instead of policy issues (Lipson, 2002) but in order to measure funding for adaptation planning and implementation, the amount of funding allocated adaptation in national budgets is of great importance. This indicator determines whether countries are financially prepared for adaptation and whether budgets include or are accessible to fishing communities.

17. *Private sector contributions*: Due to the huge funding gap and inadequate budgets created by states and public funding institutions there has been a number of private organisations with major financial investments in climate change (Metz, 2001). The main focus of private funding institutions are to transform the economy of the world into a low-path and to build resilience for developing countries as well as vulnerable sectors in developed countries (Bao, Miao & Chen, 2008). For instance, institutions such as pension funds, insurance companies, and sovereign wealth funds have various investments in this sector. Even though significant improvements have not been achieved by these funding institutions it is important to measure in order to assess their contributions. This

research measured the presence and actions of private funding organisations for this attribute.

18. *Foundations/trust /multi and bilateral agreements:* There has been several foundations, trusts and other funding agencies that have been working to fund climate change adaptation in different countries around the world. These organisations and agreements are mostly set up to address global, social and environmental issues. The Rockefeller Foundation, Oak Foundation, Greenpeace and several other international development organisations have over the years developed strategies and services to protect people and communities from environmental and changing global climate. Their contribution in the Caribbean has been significant and therefore an important measure. The measurement is based on the number of known activities of these foundations in selected countries.

4.3.6 Science and Technology to Inform Adaptation

National science and technology assessment has been emphasized in several areas of adaptation preparation and intervention. King (2004) argued that different types of science and technology is needed for adaptation. The hard forms of technology such as irrigation and drought resistant needs are as important as soft technologies such as crop rotation and climate insurance or there could be a combination of the two (Bark, 2009). Local radar for tracking storms and the link with international radar to fine-tune tracking in local communities has been the main type of usable technology in most countries in the global south. Others are coastal protections technologies such as sea defence walls but they

are seen to be very expensive and have damaging side effects (Klein et al., 2001). Nowadays, rain water harvesting which involves the collection of water for different uses has been seen as a cost effective technology for adaptation in communities around the world. Measurement of these indicators is based on availability of early warning technologies, technology based interventions, and national technology needs assessment reports on science and technology.

Indicators for Science and Technology to Inform Adaptation

19. *Early warning tools and technologies:* There are so many ways by which people will adapt to climate change for instance, people can change their behaviour, move to a different location, or change their occupation but different forms of technology can also be employed to adapt, many of which are already available and widely used. Hard technologies such as early warning systems, sea defence walls, irrigation systems and drought resistant seeds and soft technologies such as crop pattern change have been found in most climate technology literature (Klein et al., 2001). These indicators are important because most of these technologies are locally based and have seen a lot of public/local participation and stakeholder involvement. Fishers in most communities have taken advantage of different early warning systems to cope with storm surges, hurricanes and other extreme weather events that they may encounter in their fishing expeditions (Harremoes, 2013).

20. *Technology based interventions:* Many technology based interventions have existed in many developing countries and these technologies are considered to be

one of the key elements to plan and implement climate change adaptations. These interventions vary from one local community to the other due to local requirements. Therefore an obsolete technology in one area could be functional in the other. While some technologies are considered to be advanced (biotechnologies, nanotechnologies, radar systems and geo-engineering) others are simple (rain water harvesting and irrigation). Since technology is of great importance in climate change adaptation in fishing communities it is important for it to be assessed.

21. *National Technology Needs Assessment (TNA) reports*: These are a set of activities that identify and determine adaptation technology priorities of communities and countries as a whole. The assessment gives the opportunity for countries to monitor their needs for techniques, services, new equipment, capacities and skills that are important for adaptation and to minimise the vulnerability of sectors that are affected by climate change. This assessment is supported by the Global Environment Facility (GEF).

4. 4 Compiling and Computing Indicator Scores

Computing and measuring of above components and their indicators are important because they reflect the dynamics and complexity of climate change adaptation policies and it helps us to understand the synergies as well as readiness levels between different adaptation policies and programs from the Caribbean. Extensive policy review exercise and document analysis were carried out considering key elements/concepts -‘communities’, ‘fisheries’, fish, and ‘fishing communities’ - in adaptation documents gathered. A

consistent and systematic search for these key words were applied to documents, case studies, newspaper articles, blog posts, presentations and posters as well as relevant government websites. In order not to search for irrelevant and vague words the search was limited to key words; ‘fish’, ‘fishery’, ‘fishing’ and ‘community’ which are of importance to this study.

Ordinal scaling system for measurement and scoring was used based on detailed analysis of extracted data from the documents. Ordinal scale is a very common application used in marketing, medical and agricultural research. Ordinal scaling has also been used in researches that involve experimental biology and psychology. Even though it has been classified as an old mathematical and numerical tool, it accurately helps to weigh numerical information of a phenomena. For instance, Engloner (2012) used the ordinal scale method (Kohler’s ordinal scale) to assess aquatic macrophyte and ended up with a logical and ordered classification system. Based on these ordinal scaling method, components and indicators were measured using an easy ordinal scale from Zero (0) to Three (3). All 21 indicators were measured and scored using this simple ordinal scale method because the measurement categories have a logical relationship and their degrees of difference can be outlined. In this research “community” is defined as a social unit of people that share common ideals and values as well as common characteristics or interests. “Fishing communities’ are people that are greatly reliant on, or substantially involved in, the harvest or processing of fishery resources to meet their social and economic needs.

For Communities, documents must show evidence of community education and awareness programs; community working groups; public engagement initiatives;

curriculum development activities; public private partnerships; cross sectorial partnerships; and community research institutions and facilities. For Fisheries, documents must demonstrate the following: climate change funds for fisheries; climate change programs and plans focused on fisheries infrastructure such as wharfs, boats, nets; early warning weather systems for fish activities like fishing expeditions; ministries, departments and units for fisheries; and other important information on fisheries such as aquacultural activities. Fishing Communities: education and awareness programs in fishing communities; fishing community working groups; public engagement initiatives; curriculum development activities in fishing communities; public private partnerships; cross sectorial partnerships in fishing villages; and funding initiatives which are accessible to fishing communities.

Giving the constrictions and limitations of this research, some published literatures may be have been overlooked. Some documents such as those found in grey literature may be meaningless and might not reflect the real situation about readiness of countries in relation to communities and fisheries. Scores only look at the presence of communities, fisheries and fishing communities in documentations and this does not say anything about the quality of adaptation efforts by countries because results are based on only what is available in the documents and not actual on-the-ground results. Therefore, one does not know the true readiness of countries. Also, the results may either be over-stating readiness or understating it and this depends on differences in documentation and reality. However, this is a good first step towards a more integrated and comprehensive future research.

Table 2: Detailed description of indicator scores

Score	Explanation of Indicator scores
0	No information/data available on indicator
1	Data available but no information on community, fishery and /or fishing community
2	Data available with information on community, fishery and /or fishing community (Any two concepts represented)
3	Data available with information community, fishery and fishing community (All three concepts represented)

For detailed descriptions of scores and methods used consider the following: if documents demonstrate or exhibit all three attributes communities, fisheries and fishing communities, a score of three (3) is given. Any two of the attributes a score of two (2) is given, any only one of the attributes a score of one (1) is awarded. A zero score (0) score means none of the attributes is shown in the documents. However, it is important to outline

The computing and compiling process show all three elements will have a maximum score of 3 and a minimum score of 0. The extracted information from the indicators were then analysed using basic summation and descriptive statistics tools from Microsoft Excel 2013. The scores were then standardised to ensure a more useful measurement and to provide accurate baseline of components. This ensured a reliable depiction of components and their respective indicators. To obtain these, a value of 100 was multiplied to all average figures obtained from the indicators for standardisation purposes. All indicators are treated equally within a component and all components are treated equally. A simple formula for computing of score is shown below:

$$Score = \frac{\sum \text{Indicators}}{\text{Number of Indicators} * \text{Maximum Indicator Score}} * 100$$

Sum of indicator scores divided by number of scores multiply by maximum indicator scores all multiply by 100. From the formula, Σ means (sum of indicator scores).

Based on my method the maximum indicator scores is 3 (as shown on Table 3 above). An Adaptation Readiness Matrix was then created for each country in alphabetical order. For each data cell (Microsoft Excel) within the matrix, useful explanations were provided. Five types of data cell can be found in the Adaptation Readiness Matrix: (i) Cell 1 outlines Ford and King's readiness components; (ii) Cell 2 shows the essential indicators for adaptation; (iii) Cell 3 demonstrates the scores obtained by each indicators; (iv) Cell 4 provides justification for the scores or marks obtained; and (v) Cell 5 provides the evidence of documents in the form of references (See appendix).

Percentages from the thirteen (13) selected countries and Ford and King's adaptation readiness components were displayed in the Adaptation Readiness Matrix based on the overall analysis of data. Scores were then categorized using high, moderate and low to determine the levels of readiness among countries. A score of 60% - 100% (>60%), =High adaptation readiness score, 50% - 59% = Moderate adaptation readiness score and 0 % – 49% (<50%) = Low readiness adaptation score. The rational for the categorization of scores were based the general level of development in the region (mainly developing countries based UN standards), it was also based on the amount of funds committed to environmental problems in the region. All scores were based relative to island countries in the Caribbean only. The range of scores compared to other regions like Europe and North

America might differ because their levels of vulnerability and readiness are different. These percentages were outlined to help compare information on the overall analysis of adaptation readiness in relation to communities, fisheries and/or fishing communities only. Microsoft Excel 2013 was used to construct graphs, tables and for all complex calculations that are necessary for this research.

In order to illustrate the nexus between socio-economic reports in the form of Human Development Index (HDI), Gross Domestic Product (GDP) per capita, fishery as a percentage of GDP, and adaptation readiness scores, data on these economic indicators were collected and compiled for the UN database, the World Bank website and the FAO database. I used RSudio (an open source integrated development environment (IDE) for R, a programming language and software for statistical computing and graphics). It was used to graphically show the relationship between Human Development Index (HDI), Gross Domestic Product (GDP) per capita, fishery as a percentage of GDP, and adaptation readiness scores.

Chapter 5: Results

5.1 Adaptation Readiness Index by Country

The study identified 13 island countries in the Caribbean. They include Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines as well as Trinidad and Tobago. It is important to understand that this study represents the extent to which countries are dealing with climate change policy approaches in fisheries, communities and fishing communities.

5.2.1 Adaptation Readiness Index for Antigua and Barbuda

The twin-island state of Antigua and Barbuda is situated in the ‘heart’ of the Caribbean, with the larger part of the country in a low lying area. Antigua is about 280 km² in area, while Barbuda is 160 km². Antigua boasts the largest area of fresh water (lakes and rivers) in the entire Caribbean. Barbuda has a reef and is comprised of numerous lagoons that support the country’s beaches and fishery resources. Antigua and Barbuda is prone to climate disasters such as hurricanes, typhoons and coastal erosion. The government therefore has to mainstream climate change and other natural disasters into national development policy frameworks. The Figure below shows the performance of Antigua and Barbuda.

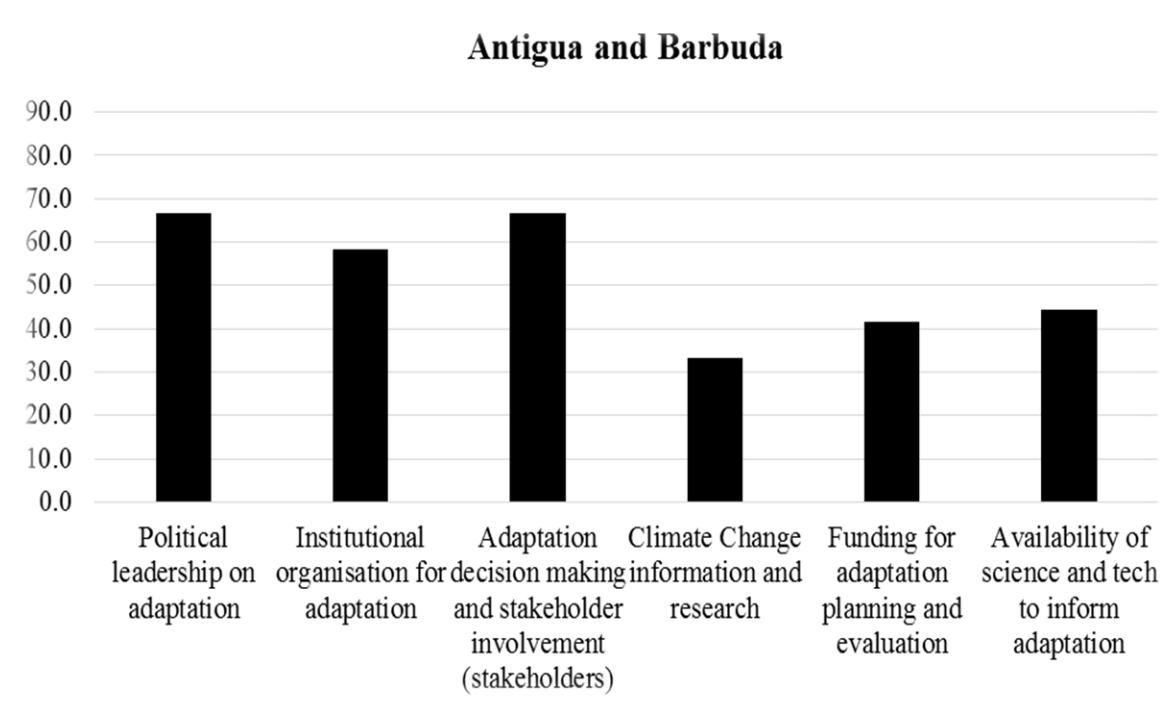


Figure 5. Adaptation readiness index for Antigua and Barbuda

The results for Antigua and Barbuda shows Political Organisation and Adaptation Decision Making components for climate change readiness recorded high adaptation readiness. They each scored 67%. Institutional organisation had moderate readiness with a score of 58%. Three components - information and research, funding, and science and technology- according to my study had low readiness scores. They recorded 33%, 42% and 44% respectively.

The high readiness components was mainly because of Antigua and Barbuda's national strategy on climate change which contains information on the importance of fishery and fishing community. Education and awareness creation programs, which were attributes of adaptation decision making, had evidence on community participation. For

instance, the National Capacity Self-Assessment (NCSA) developed textbooks, student guides, and environmental certificate programs to help enhance local knowledge on climate change adaptation. Antigua and Barbuda have high readiness on institutional organisation because of the existence of National Office of Disaster Services (NODS). NODS has projects and programs that are fisheries, communities and/or fishing communities focused.

It is important to note that the Government of Antigua and Barbuda has also created a division for fisheries within the Ministry of Agriculture, Lands and Fisheries, hence a moderate readiness score of 58%. Although the Government of Antigua and Barbuda plays a fundamental role through the Ministry of Housing, Lands, Agriculture & Environment and specifically the National Meteorological Center and the Forestry Unit, Climate Change Information and Research detailed low readiness scores. This is because the country did not have suitable research institutions to conduct environmental and climate research according to this study. The two public universities identified are focused on health science education rather than climate research. CARIBSAVE's Climate Change Risk Atlas (CCCRA) provided much recent information on Antigua and Barbuda climate hotspots, but there is no data on the elements of importance in my study.

In addition to inadequate research facilities, climate change adaptation programs through budgetary allocations showed no evidence of fisheries, communities and /or fishing communities. With increasing frequency of environmental hazards, such as tropical cyclone and hurricanes, the government of Antigua and Barbuda should consider having more budgetary allocations and provide funds for communities.

Antigua and Barbuda will have to partner with external research organisations, such as the CCCCC, CARDI, UNDP, and The University of the West Indies, among others to assist in adaptation research just as Jamaica, Barbados, and St Vincent and the Grenadines. Similarly, enhancing accessibility to The UN's Green Climate Fund (GCF) through policy reconstructions can support financing climate resilient development programs, taking into account the needs of sensitive sectors such as fishery and fishing communities.

5.2.2 Adaptation Readiness Index for the Bahamas

The Commonwealth of the Bahamas has 700 islands and approximately 2,500 small islets or cays. However, only 22 of these islands are occupied or inhabited. The islands are typically flat, with white sand beaches. Though the Bahamas have no rivers and lakes, there are tidal creeks, wetlands and mangrove forests that support few inland/freshwater fishing activities. Most fishing activities are focused on marine fisheries. The contribution of fishery to the GDP of the Bahamas is estimated at 1.03% (2012). Bahamas is considered the richest country in the region with a GDP per capita of about USD\$21, 600 in 2012. (Gov't of Bahamas, 2013). Adaptation readiness results for Bahamas in the fishery sector, community and /or fishing community are illustrated in Figure 6.

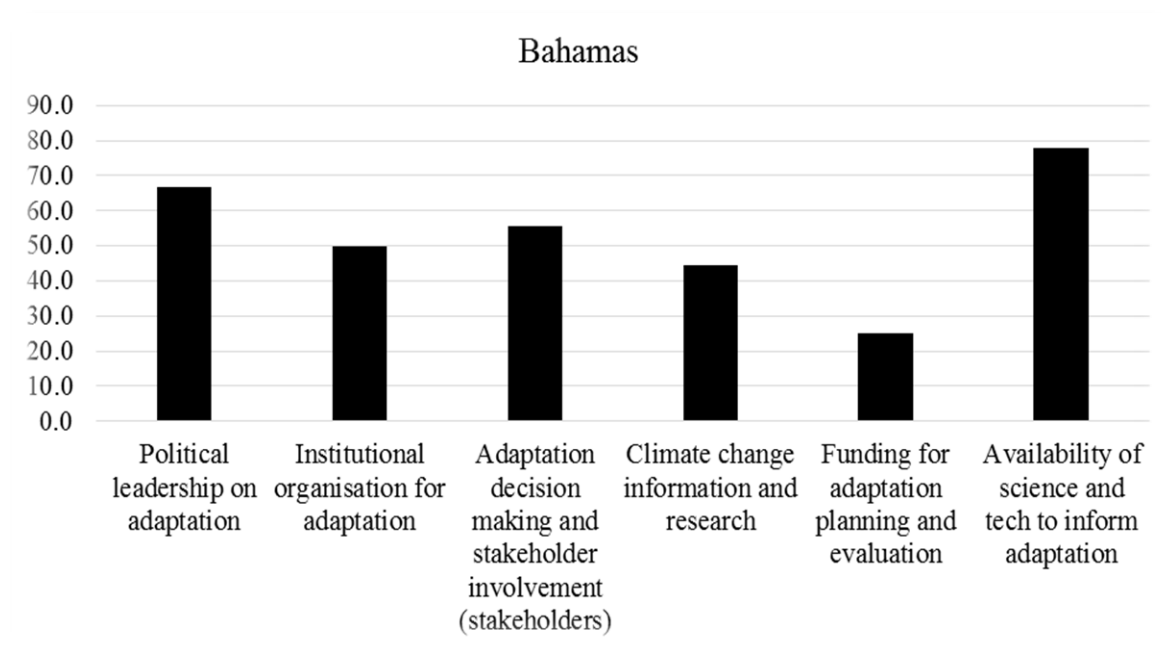


Figure 6: Adaptation readiness index for Bahamas

Findings for this study shows that Bahamas had high readiness scores in two components - Availability of Science and Technology to Inform Adaptation (78%) and Political Leadership (67%). Results confirmed that Bahamas had robust science and technology programs and a comprehensive National Capacity Needs Self-Assessment Report with information on community engagement and fishery, hence the high score. For example, the provision of domestic rainwater harvesting and aquacultural activities, in addition to installation of local radar in communities for tracking storms is reason for the high readiness score in science and technology.

Also, two major national strategies and policies have been put in place to further respond to climate change challenges. They are the Bahamas National Climate Change Policy and the UNFCCC's National Communications on Climate Change. These strategies

and policies discussed satisfactory inclusion of fisheries, communities as well as fishing communities. The strategies further had information on structures to support fishery resources, hence the high score for Political Leadership.

The result further indicate that two components -Funding and Information and Research -had low adaptation readiness. Funding scored the least, with 25%, while Information and Research scored 44%. In 2012, Bahamas received grants totaling US\$4.8m from GEF (Gov't of Bahamas, 2013), however, there was no information on the funds' access to communities or the fishery sector. Funds received from The Adaptation Fund, UK's International Climate Fund, Norway's International Climate and Forest Initiative (see appendix) according to the study did not adequately provide details on the funds availability to communities or fishing communities.

Interestingly, Dominican Republic, a poorer county, has demonstrated the use of similar funds in adaptation planning in the fishery sector and communities. For instance, in 2014, Dominican Republic committed USD\$1m from their national budget and the Adaptation Fund to train teachers from 2014-2016 in climate adaptation programs in local communities (UNITAR, 2014; Government of Dominican Republic). This example can be emulated by Bahamas.

5.2.3 Adaptation Readiness Index for Barbados

Barbados is the most easterly of the island countries studied. It is relatively flat, with little surface water and a few streams found on the eastern coast. The physical features of Barbados are its lowlands, or gently sloping, terraced plains, separated by rolling hills that mostly parallel the coasts. Altitudes in the inland vary from 180 to 240 meters above sea

level. Barbados is ranked by The Reefs at Risk Revisited report as one of the most dependent countries on reefs and a country whose reefs are under threat (Simpson et al. 2012). These make the country very prone to the impacts of climate variability and change. The table below shows the performance of Barbados:

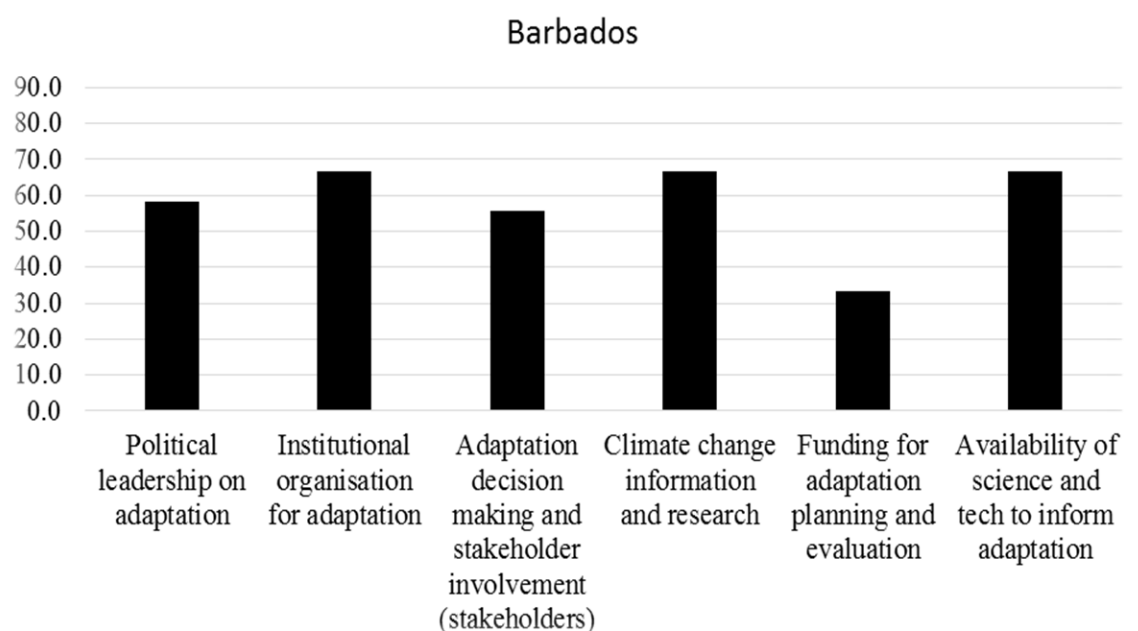


Figure 7: Adaptation readiness index for Barbados

The outcome of this study shows that components, such as Institutional Organisation, Information and Research, Science and Technology obtained 67%, signifying high adaptation readiness scores. Political leadership and Adaptation Decision Making scored 58% and 56% respectively showing moderate readiness. However, Funding for Adaptation Planning measured 33%, demonstrating a low readiness.

Rising climate change developments need organizational restructuring and ministerial reforms to accommodate new issues and linkages. My study identifies the

Government of Barbados' efforts in restructuring and reorganising of the Ministry of Energy and Environment, Meteorological Department, as well as the Department of Emergency Management in addition to the formation of the Central Emergency Response Organization (CERO). These institutions demonstrated support for fisheries, communities and/or fishing communities, hence the high score. The creation of the National Climate Change Committee and National Heritage Department to organise and coordinate community based adaptation programs was another reason for the high readiness.

Also, Climate Change Information and Research measured high scores due to projects from several internal and external research institutions, such as the Centre for Environmental Resource and Management Studies at the University of West Indies, Barbados Environment Service, CARIBSAVE, and CCCCC. Projects and programs from the photovoltaic systems, solar panels for communities and other renewable energy initiatives in communities exhibited good scores for science and technology (see appendix).

However, Funding for Adaptation Planning and Evaluation was by far the lowest-scoring readiness component in Barbados because it recorded 33%. Inter-American Development Bank grant for Sustainable Energy Framework, The GEF grants, and grants from the Australian Government is central for the success of adaptation preparation in Barbados. However, these funds did not indicate any information about community, fishery and fishing community. Comparing with Grenada's budgetary allocations for climate change and fisheries which had moderate scores in funding, it is important Barbados could have improved in their funds allocation. Barbados could also take advantage of the new

capitalization policy of the Green fund institution which has the potential for the reimbursement of adequate funds for adaptation.

5.2.4 Adaptation Readiness Index for Cuba

In terms of population and land size, Cuba is the largest among the island countries in the Caribbean. It is located between the Atlantic Ocean and the Caribbean Sea , bounded on the north by the Straits of Florida, on the northeast by Nicholas and the Old Bahamas Channel. Cuba lies in the path of hurricanes and cyclones with destructive storms which are common in September and October (Gobierno de Cuba, 2012). The country is low lying, which makes it vulnerable to coastal flooding and erosion. Cuba is exposed to the risk of climate change and this has necessitated the development of new strategies for adaptation in vulnerable coastal communities. The result for Cuba is illustrated on Figure 8 below:

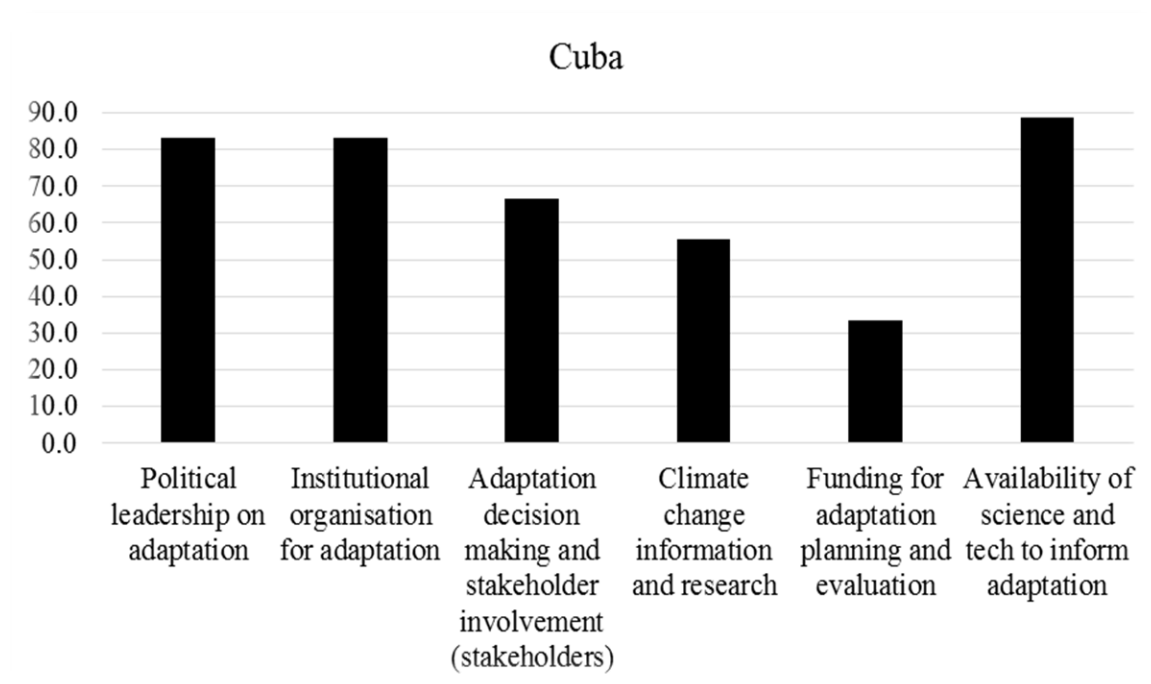


Figure 8: Adaptation readiness index for Cuba

The results for adaptation readiness for Cuba indicate that four out of six components exhibited high adaptation readiness scores in terms of community involvement, fisheries and/or fishing communities. Cuba recorded as high as 89% in Availability of Science and Technology to Inform Adaptation, 83 % in both Political Leadership and Institutional Organisation, and 67% in Adaptation Decision Making and Stakeholder Involvement. Nevertheless, Cuba measured low in funding for adaptation planning with a score of 33%. Cuba is considered according to this study as the most prepared country for climate change readiness in community involvement, fishery and /or fishing community.

The Center for Risk Reduction Management (CRRM) provided special attention to technology based interventions for adaptation readiness. CRRM established a world-class meteorological institute as well as weather and climate tracking systems in all 15 provinces of Cuba. These institutions have direct link with communities and other climate sensitive sectors of the economy which includes the fishery sector. This explains the high score recorded in Science and Technology for Adaptation investigated in Cuba.

In addition, Political Leadership and Institutional Organisation measured high due to the sophisticated National Disaster Risk Reduction Framework known as the ‘Civil Defense System’ which is a part of Cuba Emergency Response System. As part of this emergency system, committees have been set up to check evacuations and shelters prior to storms and other intense weather conditions. In addition, disaster management, hurricane preparedness and climate change adaptation are taught in schools to equip students with requisite knowledge for future disasters. Likewise, community awareness programs were organised to practice drills before each hurricane season.

National Environmental Strategy and Action Plan on Adaptation to Climate Change are the two major strategies for adaptation preparedness in Cuba. These strategies provided the opportunity for integrating proposed adaptation plans which incorporated community, fishery and/or fishing community. These reactions to adaptation are part of the government’s commitment to ensure human security and building the adaptive capacity for disaster risk reduction and management. With a comprehensive and integrated National Environment Fund, in addition to national budgetary allocation for adaptation, it was

observed that there was insufficient data gathered on community, fishery and/or fishing community.

Even with UNDP's 17 collaborative projects in Cuba with a total investment of approximately USD \$45m did not indicate adequate information on all three components which is the focus of this research. Similar trend was observed for CARE International's funds for adaptation projects. (See appendix). It is therefore recommended for the Government of Cuba to generate adaptation funds through the Green Fund, GEF Strategic Priority on Adaptation funds as evident in Dominican Republic and Grenada.

5.2.5 Adaptation Readiness Index for Dominica

Dominica is a mountainous island with volcanic origin situated in the middle of the 'eastern Caribbean series of islands'. The country's natural resources have been well conserved as such termed the 'Nature Isle of the Caribbean'. Dominica is made up of rugged and steep terrains with about 145 km of coastline. It has extensive network of streams and rivers due to its high rainfall levels. Contrary to most countries in the Caribbean, Dominica is more dependent on agriculture and fishing than tourism (Simpson et al. 2012). The geographic features of Dominica makes it susceptible to natural disasters including climate change. The results for Dominica is graphically represented below:

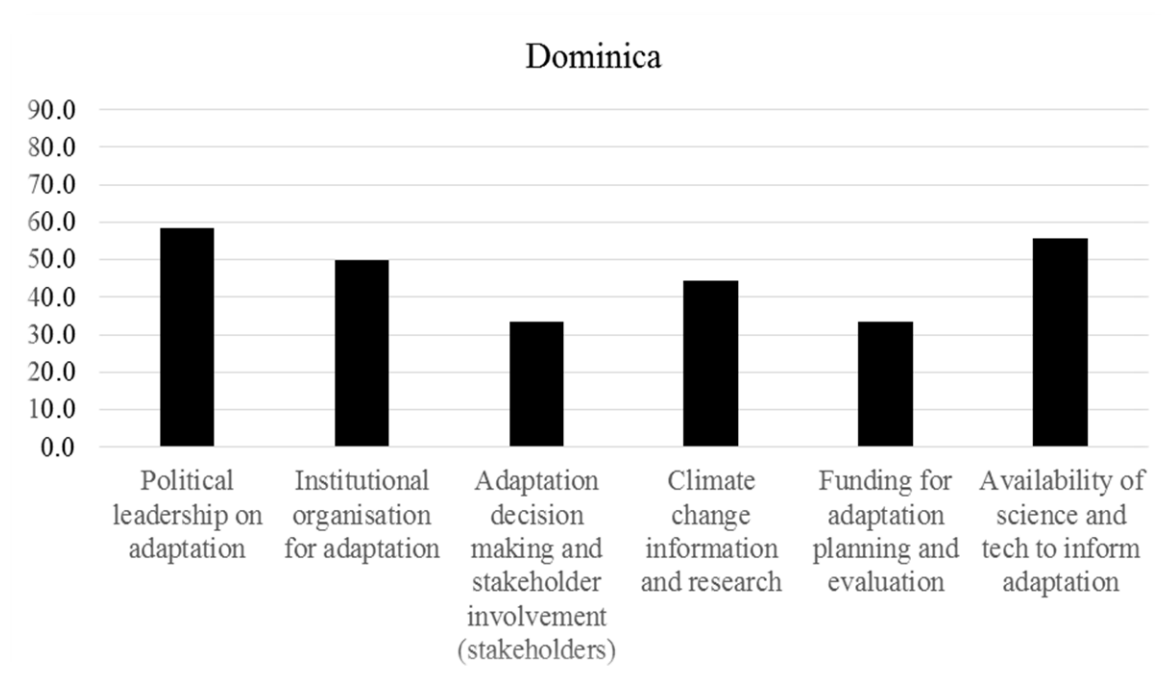


Figure 9: Adaptation readiness index for Dominica

The result shows that Dominica had moderate adaptation readiness in three components. They are Political Leadership on Adaptation (58%), Science and Technology (56%) and Institutional Organisation (50%). Dominica also had low readiness in three components, Climate Change Information and Research (44%), Funding (33%), and Adaptation Decision Making and Stakeholder Involvement (33%). Dominica is the country with the lowest scores as well as the least prepared country for climate change adaptation in community, fishery, and/or fishing communities measured in this study.

Dominica has a good record of Political Leadership on environmental management which has clearly manifested in the achievement of the Millennium Development Goals (MDGs) on environmental sustainability. Moreover, the Government of the Dominica presented their National Strategic Program for Climate Resilience (SPCR) and received

authorisation for the Pilot Program for Climate Resilience (PPCR) projects. (Government of Dominica, 2013). In addition, the government also outlined UNFCCC's First and Second Communications on Climate Change and Climate Change Adaptation Policy and Action Plan. These strategies resulted in series of consultations with all national stakeholders, including civil society and government agencies. The study however, was unable to ascertain information on fisheries and fishing communities. This accounts for the moderate score recorded for this component.

In Dominica's First and Second National Communication, attention was given to science and technology based interventions for adaptation. The documents suggested the installation of tidal gauges and construction of rainwater harvesting systems in several coastal communities across the country. However, Dominica recorded small marks because these projects are not centred on fisheries and fishing communities. Similarly, the formation of the National Climate Change Steering Committee as well as the technical working groups on climate change as part of institutional organisation had been focused on community but paid less attention to fishery and/or community. This trend was also observed in national consultative workshops.

The result further demonstrates Information and Research for Adaptation are among the weakest components for adaptation planning and readiness in Dominica. This is mainly because there is no evidence of climate change vulnerability hotspots, and no scientific agencies for climate change adaptation. The Caribbean Regional Fisheries Mechanism reports and researches have only examined fisheries but nothing was located on community. This research has not identified any national climate change assessments

which is a major attribute for Information and Research component, hence the low readiness scores observed.

The low readiness score for Funding and Stakeholder involvement is mainly due to the inadequate information on communities, fisheries and fishing communities. Initiatives such as Climate Investment Funds, World Bank's Strategic Climate Fund and GEF grants were identified in the study as the main funding agencies. Yet, the study did not see any proof of the fund's access to communities or programs that are related to fisheries and fishing communities. Public engagement programs were not well represented in stakeholder involvement initiatives.

5.2.6 Adaptation Readiness Index for Dominican Republic

Dominican Republic is located between the Caribbean Sea and the North Atlantic Ocean and bounded at the west by Haiti. The country is prone to a wide range of natural disasters such as hurricanes, earthquakes, floods, and landslides from June to October due to its location. According to IPCC (2007) report, Dominican Republic is one of the ten most vulnerable countries in the world to climate change impacts. Another study projected that due to sea level rise, by 2030, the Dominican Republic could lose 29 percent of Bavaro beach in Punta Cana, one of the country's most lucrative tourist destinations and consequently sway Dominican development prospects (USAID & Dominican Republic, 2013).

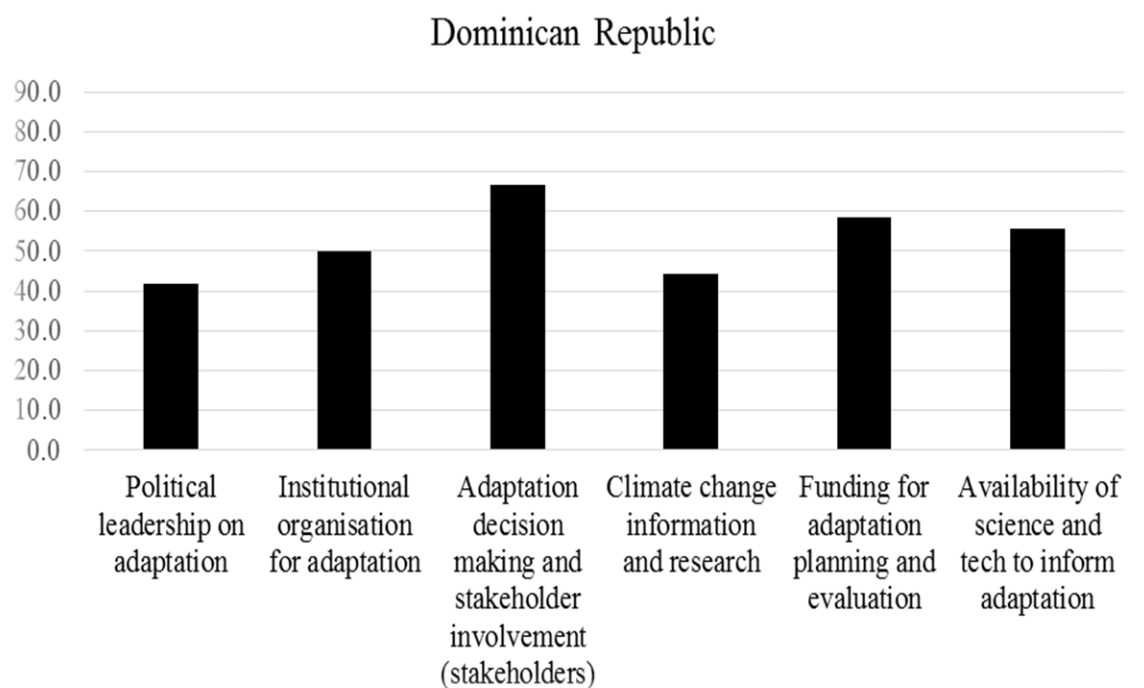


Figure 10: Adaptation readiness for Dominica Republic

The results establish that Dominican Republic had high adaption readiness (67%) in only one component- Adaptation Decision Making and Stakeholder Involvement. The country had low adaptation readiness in Political Leadership (42%) while Climate Change Information and Research recorded (44%). Also, Political leadership recorded 42% and considered the lowest scored component in the region. Funding, Science and Technology, and Institutional Organisation had moderate adaptation readiness with scores ranging from 58%, 56% and 50% in that order. Interestingly, although Dominican Republic recorded a moderate score in Funding (58%), it had the highest score among all the island countries in the Caribbean region. This information is illustrated on Figure 10 above.

Dominican Republic had a high readiness score on Adaptation Decision Making and Stakeholder Involvement mainly due to its public engagement programs, as well as

education and awareness plans organised and supported by the government and Non-Governmental Agencies in addition to International Organisations such as The Nature Conservancy, PRONATURA, USAID, UNDP and GIZ (See appendix). The high score recorded can also be attributed to outreach programs organised for communities and fishing communities. A classic example is the program to train teachers on climate change in Dominican Republic which is relevant for stakeholder involvement (UNESCO, 2014).

Political Leadership and Information and Research had low adaptation readiness because this study revealed that Dominican Republic's the National Development Strategy and National System for Prevention, Mitigation and Response to Disasters did not have any information on communities, fisheries and/or fishing community. This was also observed with the National Adaptation Plan of Action. Research and information from the Technological Institute of Santo Domingo (one of the major research institutions in Dominican Republic) and The Caribsave Climate Change Risk Atlas did not have enough evidence on the three main components of importance in this research.

Nevertheless, the country had the highest score in Funding for Adaptation Planning and Implementation. In 2014, the government budgeted USD\$1 million towards training teachers in communities in climate change adaptation. Most of the selected communities for these training had fishing as their primary occupation. Also, the Global Environment Facility Trust Fund, and Sur Futuro Foundation provided several funding opportunities for programs in fishing communities and for fishery. Similarly, USAID provided a \$2.4 million grant for adaptation funding and support in several fishing communities.

5.2.7 Adaptation Readiness Index for Grenada

The Tri-island State of Grenada is located between Trinidad and Tobago and St. Vincent and the Grenadines. The State comprises of the islands of Grenada, Carriacou and Petit Martinique and numerous small abandoned islands. The relief of Grenada has chains of distinct watersheds and several mountains. Carriacou on the other hand have considerably fewer mountains. It is important to note that Grenada has no rivers hence do not have inland or fresh water fishing activities (Simpson et al. 2012). However, Grenada has large coral reefs and sea grass beds that is critical to supporting marine fisheries. Grenada is in the path of major hurricanes and tropical cyclones. The result for Grenada is shown below:

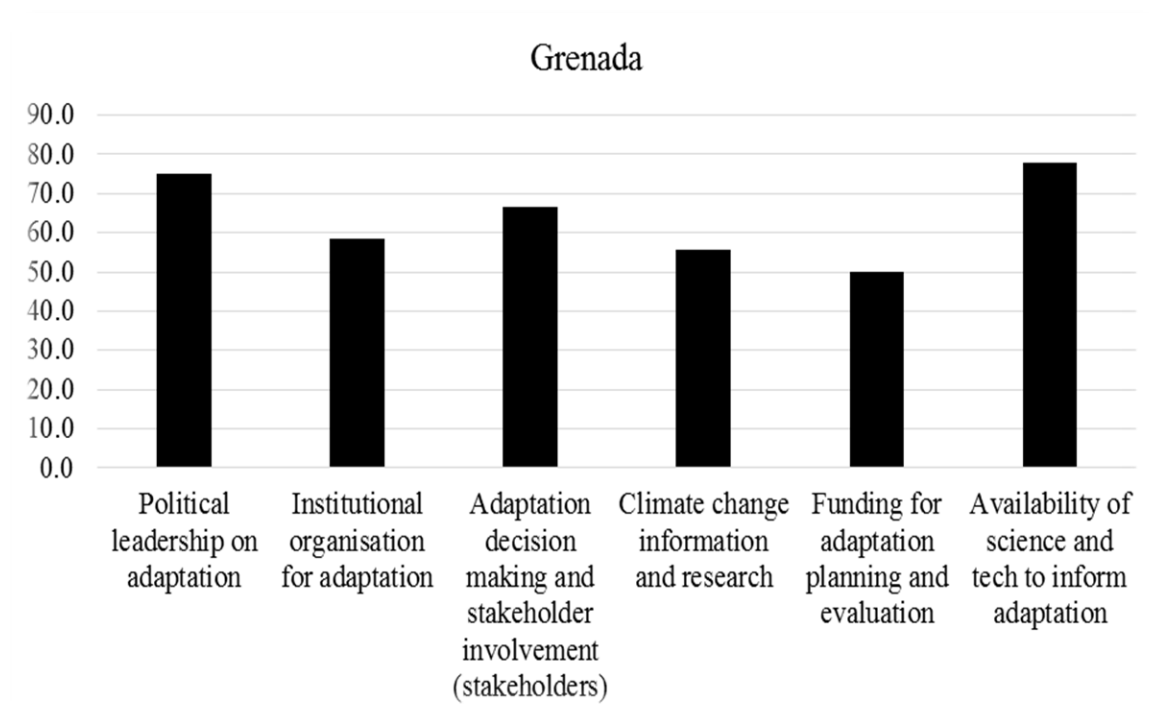


Figure 11: Adaptation readiness index for Grenada.

The results for Grenada indicate that three components- Availability of Science and Technology, Political Leadership, and Adaptation Decision Making- had high adaptation readiness scores of 78%, 75% and 67% respectively. The other three components - Institutional Organisation, Information and Research, and Funding- had moderate readiness with scores ranging from 58% to 50%. Grenada's performance is one of the most consistent in this study and it is one of the two countries with a moderate (rather than low) readiness scores in Funding.

Grenada's Strategic Program for Climate Resilience, National Climate Change Policy and Action Plan, community level presentations and discussions in addition to public fora on climate change and its implications earned high scores in both Political Leadership and Stakeholder Involvement. Community mobilization programs on climate change impacts on fishery in addition to education and awareness creation for community groups in fishing communities had contributed to the high score in adaptation Decision Making and Stakeholder Involvement. Rain water harvesting in Northern Grenada, the creation of the National Science and Technology Council (NSTC), and National Capacity Self-Assessment Cross Cutting Analysis supported the high scores attained in Science and Technology for adaptation.

Moderate readiness scores recorded for Institutional Organisation, Information and Research and Funding was mainly because Grenada did not demonstrate adequate information in all three elements (community, fisheries and fishing community). For instance, the Environmental Management Committee set up by the Government of Grenada

did not reveal information on representations for fisheries or fishing communities in this study (See Appendix).

5.2.8 Adaptation Readiness Index for Haiti

Haiti occupies the western part of the Hispaniola Island and shares its eastern boundary with the Dominican Republic. Two-thirds of Haiti is mountainous, with the rest of its land surface comprising valleys, extensive plateaus, and small plains. Haiti lies openly in the path of several hurricanes, typhoons and tropical storms that destroy the country's infrastructure. The country is also susceptible to direct impacts of climate change, particularly coastal erosion and sea level rise and existing environmental stresses. Coinciding issues like high population densities, water stress, and fragile ecosystems means Haiti faces severe challenges to achieving its development goals.

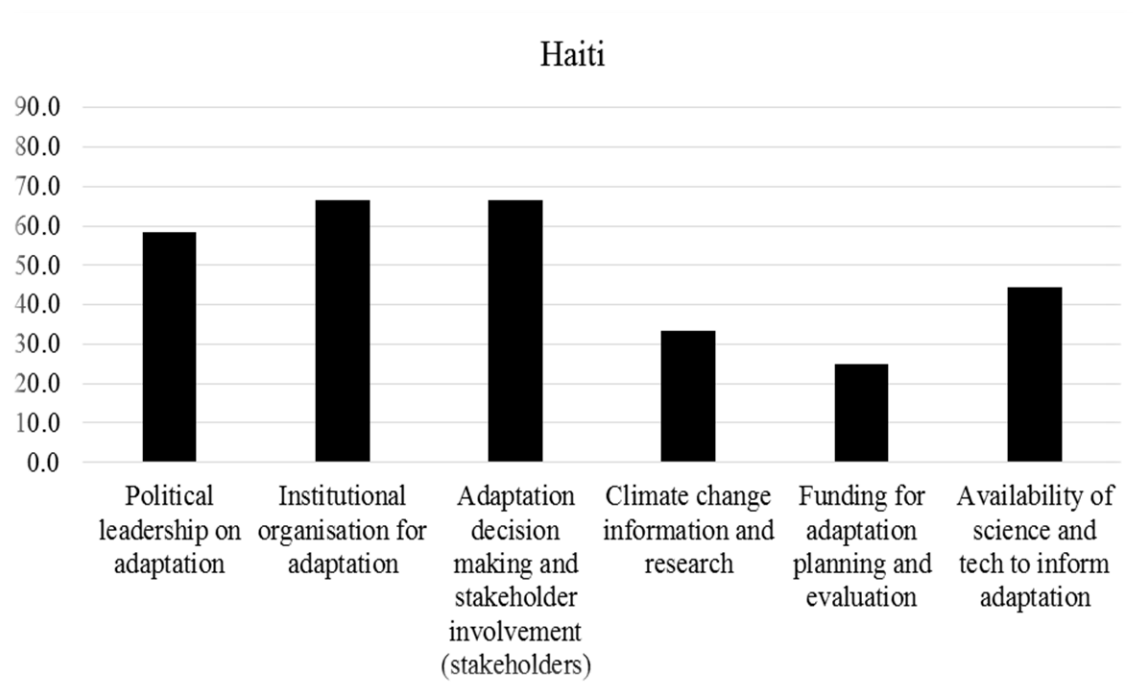


Figure 12: Adaptation readiness index for Haiti

Haiti's result shows high adaptation readiness for Institutional Organisation and Stakeholder Involvement with scores of 67% each. Political Leadership had a moderate score of 58%. Three components - Availability of Science and Technology, Climate Change Information and Funding - all had low adaptation readiness with scores from 44%, 33% and 25% in descending order. It is important to note that Haiti is one of the three countries with lowest adaptation readiness score in Funding according to this study.

The high readiness scores obtained in Institutional Organisation is because of the Strategic Program for Climate Resilience, Haiti Climate Change Programme and the National Action plan which have elements of community and fishing community. Decision Making and Stakeholder Involvement's high scores is mainly due to the training programs on climate resilience for stakeholders and decision makers in communities. The same trend is observed in community engagement initiatives organised by the Government of Haiti and several non-governmental organisations, hence the high readiness score (See appendix).

However, Haiti's low performance in Science and Technology is because of the inadequate information on technology based interventions and national technology needs assessment reports. The study could not identify research institutions, national academies and universities that are involved in climate change adaptation research on communities, fisheries and fishing communities. There is also insufficient information on vulnerability and hazard hotspots.

Funding for adaptation planning registered one of the lowest scores in the region due to the scanty information on climate change funds and private sector contributions to

climate funding. Nevertheless, multi-lateral and bilateral organisations such as GEF, USAID; World Bank Strategic Climate funds Adventist Development and Relief Agency provided some source of funding but there is no proof that the funds were accessible to communities, fisheries and fishing communities.

5.2.9 Adaptation Readiness Index for Jamaica

Jamaica is the third largest island in the Caribbean and lies 140 km south of Cuba and 190 km west of Haiti. Jamaica also has several small islands which are found along the south coast. The country is largely mountainous, with a constricted coastal plain. The island also has several bays, small cays and white-sand beaches. There are over 100 rivers in Jamaica, but they are small, not navigable and unexplored. Inland-fishing activities are common around some of these rivers.

The island suffers economic losses due to environmental effects of climate change. Severe hurricanes, increased coastal flooding and drought have left many communities incapable of developing. The Government of Jamaica is becoming mindful that adaptation is crucial to communities' sustained existence and development. The results of Jamaica are illustrated below:

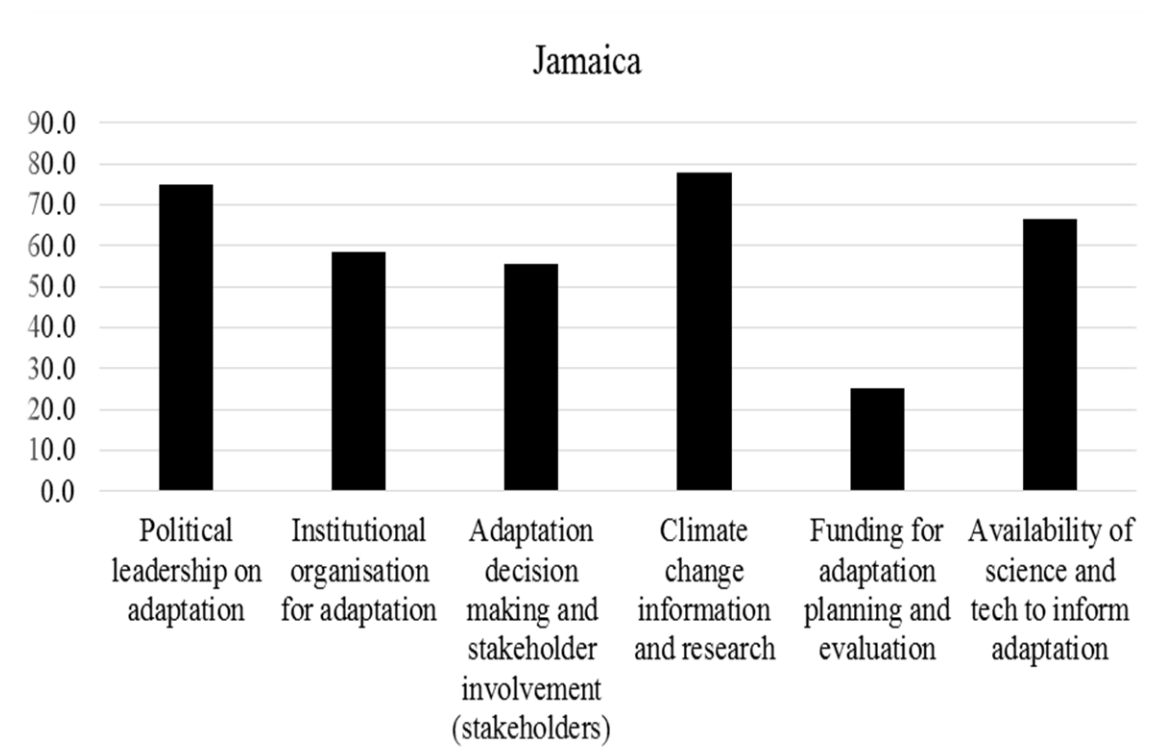


Figure 13: Adaptation readiness index for Jamaica

The results shows consistent readiness indices in most adaptation components. Information and Research (78%), Political Leadership (75%), and Science and Technology (67%) representing high adaptation readiness. Institutional Organisation and Decision Making and Stakeholder Involvement had moderate readiness with scores of 58% and 56% respectively. Interestingly, however, Jamaica scored as low as 25% in funding for adaptation planning and implementation. It is one of the three countries with very low scores in this component.

Information and Research scored high because of the availability of climate change information made available on Jamaica by University of West Indies, Caribsave, CCCCC, and C-Fish. For instance, Caribsave provided a comprehensive and integrated climate

change risk profile as well as climate change atlas for with evidence of fisheries, communities and fishing community. Jamaican National Assessment reports also provided adequate information on programs in fisheries and fishing communities.

Political Leadership's high readiness is as a result of Jamaica National Strategy and Action Plan, and Jamaican Climate Change Policy Framework which have programs that integrated fisheries, communities and fishing communities in their projects. A similar trend was recorded for the country's UNFCCC's first and second communications on climate change.

Jamaica scored high in Science and Technology because of the early warning systems and technologies in addition to community workshops on technology needs assessment. Water harvesting and irrigation facilities for local communities is worth mentioning because it also contributed to the high readiness score for Science and Technology for Adaptation Planning and Implementation.

In contrast, funding has a very low score (lowest in the region) due to the unavailability of information on private sector contributions, national adaptation resources and funds from foundations and trusts. The study recorded information on funds from GEF (USD 4.3M) and Inter-American Development Bank but there are no records of funds' accessibility to communities. Unlike other countries with national budgets on climate change, from the information collected, Jamaica did not seem to have national budgets for adaptation.

5.2.10 Adaptation Readiness Index for Saint Kitts and Nevis

Saint Kitts and Nevis is a twin island country in the Caribbean. Saint Kitts has long beaches and volcanic mountains along with many streams. Nevis is circularly shaped and bounded by coral reefs with white sand beaches. A volcanic mountain chain dominates the center of both islands. The vegetation on the central mountain range of the two islands is rainforest with a bushy cover. As a small island developing country, St Kitts and Nevis is considered to be in danger of the effects of climate change. The results of this country are illustrated on Figure 14 below:

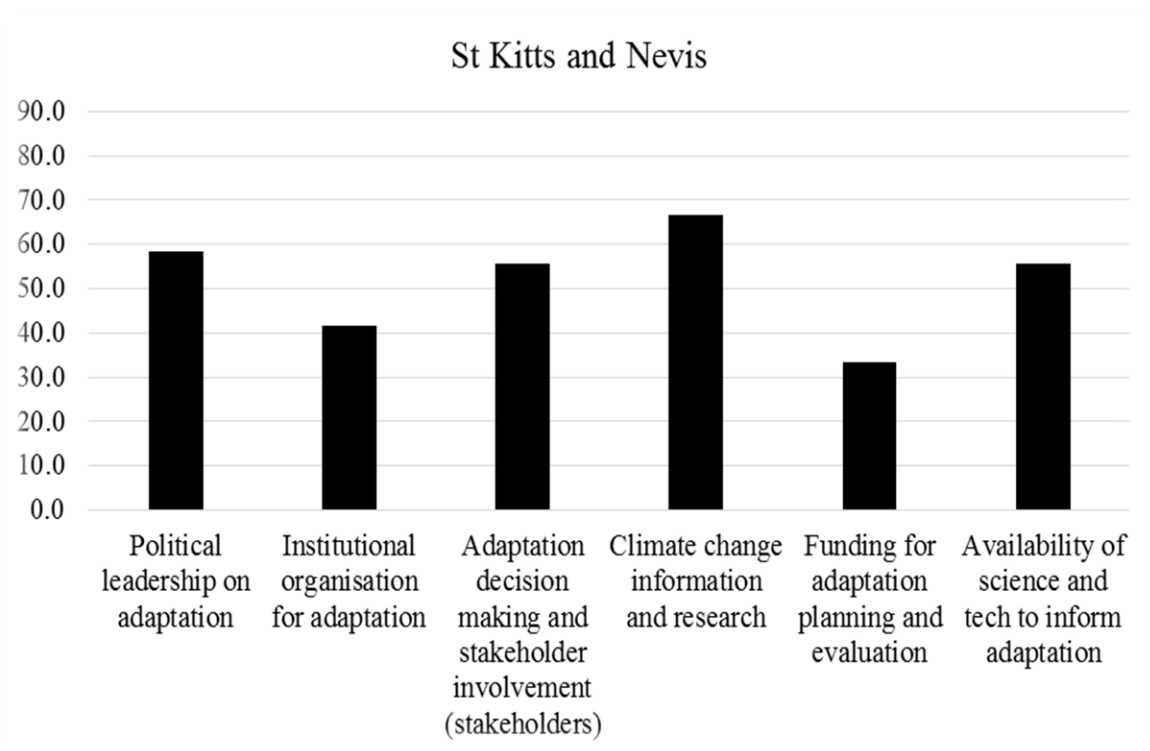


Figure 14: Adaptation readiness index for Saint Kitts and Nevis

The results indicate Saint Kitts and Nevis had high adaptation readiness in only one component- Climate Change Information and Research- with a score of 67%. Three

components-Political Leadership, Adaptation Decision Making and Stakeholder Involvement, and Availability of Science and Technology- had moderate readiness in relation to communities, fisheries, and fishing communities. They recorded 58%, 56% and 56% respectively. Two components-Institutional Organisation and Funding - had low readiness scores of 42% and 33% in that order.

Climate Change Information and Research measured high scores because St Kitts and Nevis have a detailed national action plan and several reports on vulnerability assessment. The National Capacity Self-Assessment report has fisheries and communities components that are vital to this study. Researches from external research institutions such as CARDI, CCCCC, and Caribsave among others (See appendix) also have adequate information on climate change adaptation with information on fishery community and fishing communities.

It is imperative to indicate that even though St Kitts and Nevis have extensive national strategies as well as national acts and legal frameworks for climate change, there is no information on their link with communities, fisheries, and/or fishing communities. Typical examples of such frameworks and national acts are Global Climate Change Alliance (GCCA), Nevis Disaster Management plan, Adaptation Action, among others. However, St Kitts and Nevis' Initial National Communication and the National Preparatory Process for Rio+20 has information on fisheries and fishing communities. This is the reason for the moderate adaptation readiness in Political Leadership.

Institutions such as the Department of Physical Planning, National Resources and the Environment, Department of Economic Affairs and Public Sector Investment

Programme did not have sufficient information on communities, fisheries, and /or fishing communities, hence the low readiness score. Similar trend was observed in adaptation mainstreaming initiatives to integrate disaster risk reduction into sustainable development policies.

Funding from Saint Kitts & Nevis Climate Change Budget, Clean Technology Fund in addition to resources from the Caribbean Development Bank, the World Bank, IDB and GEF lack the elements (fishery, community and/or fishing community) necessary for this research.

5.2.11 Adaptation Readiness Index for Saint Lucia

Saint Lucia is a small island developing state in the Eastern Caribbean. It is located on a volcanic ridge between Martinique (Territory) to the north and St. Vincent and the Grenadines to the south. The greatest climatic disruption in the region is hurricanes which have caused extensive damage. Nevertheless, it is important to note that Saint Lucia has had less hurricanes than several other Caribbean islands because of its southerly position. Saint Lucia is partaking in a number of adaptation projects and programs concentrating on needs in areas such as coastal zones, freshwater, tourism, and reinforcing the capability of government and non-governmental agencies to facilitate adaptation.

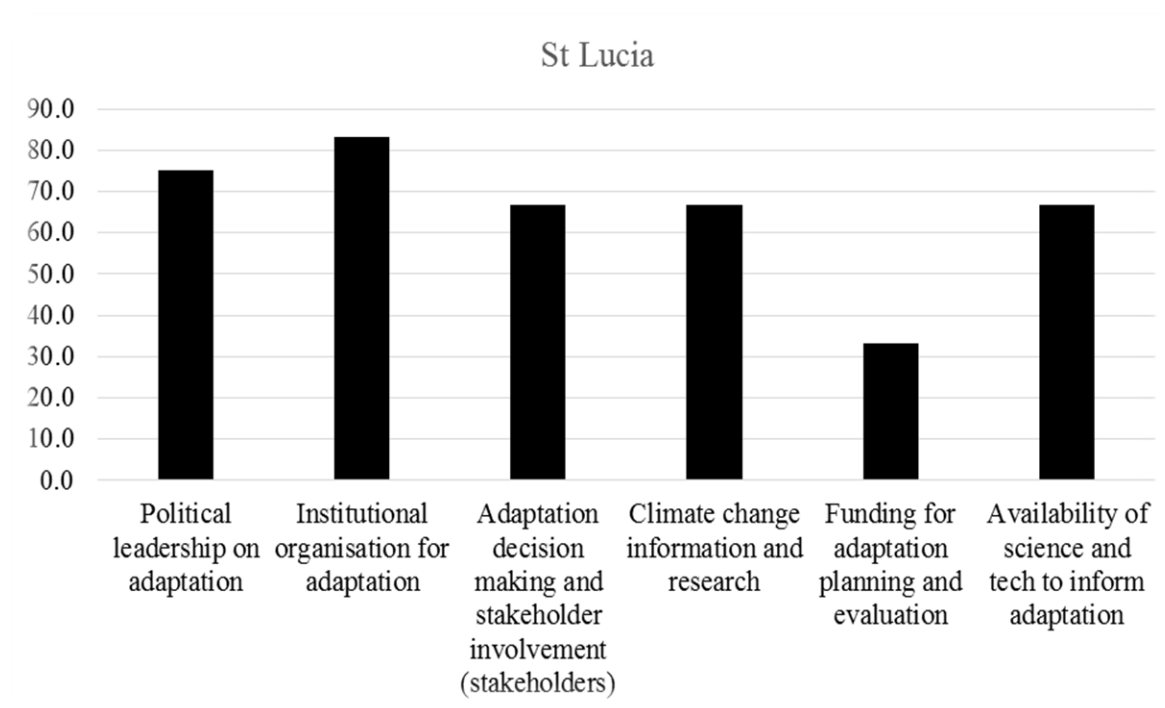


Figure 15: Adaptation readiness index for Saint Lucia

Findings from this study show that Saint Lucia has high adaptation readiness scores – related to communities, fisheries and fishing communities – in all but one component. It scored as high as 83% and 75% in Institutional Organisation and Political Leadership respectively. Saint Lucia had 67% each in Adaptation Decision Making, Information and Research as well as Science and Technology. Saint Lucia has the most consistent scores and it has ranked as the most prepared country besides Cuba. Interestingly, it measured 33% (low readiness score) in Funding.

Adaptation needs and priorities of communities, fisheries and/or fishing communities are extensively debated in the country's Climate Change Adaptation Policy and Strategy. It has also been discussed in its Initial and Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC). The

consistent result is further due to developments strategies undertaken through GEF funded projects including Caribbean Planning for Adaptation to Climate Change (CPACC) project. These projects and programs provided a national framework for addressing climate change within the fishery, communities and specifically fishing communities.

Then again, funding for adaptation planning and evaluation recorded a low readiness score of 33.3% because Saint Lucia received funds from GEF, United Nations Foundation, World Bank, Caribbean Catastrophe Risk Insurance Facility and the USAID. For example, USAID provided \$1.5 million to support adaptation programs in the country. The government of Saint Lucia also provided budgetary allocations for adaptation in its yearly budgets. Interestingly, there is no information on adaptation for fishery, community and /or fishing community in all these funding avenues.

5.2.12 Adaptation Readiness Index for Saint Vincent and the Grenadines

St. Vincent and the Grenadines consist of over 30 islands and cay. Located to the south by the Caribbean Sea, Saint Lucia lies to the north and Barbados to the east. The mainland, St. Vincent, is mountainous with a volcanic origin while the Grenadines consist of lower relief with isolated hills and also surrounded by coral reefs that are important for fishing and tourism. The island of Grenadines is highly dependent on coastal environmental activities for its economic existence. The country has a large coral reef (about 140sq km) which supports livelihoods directly and indirectly in fisheries. The results for Saint Vincent and the Grenadines are shown below:

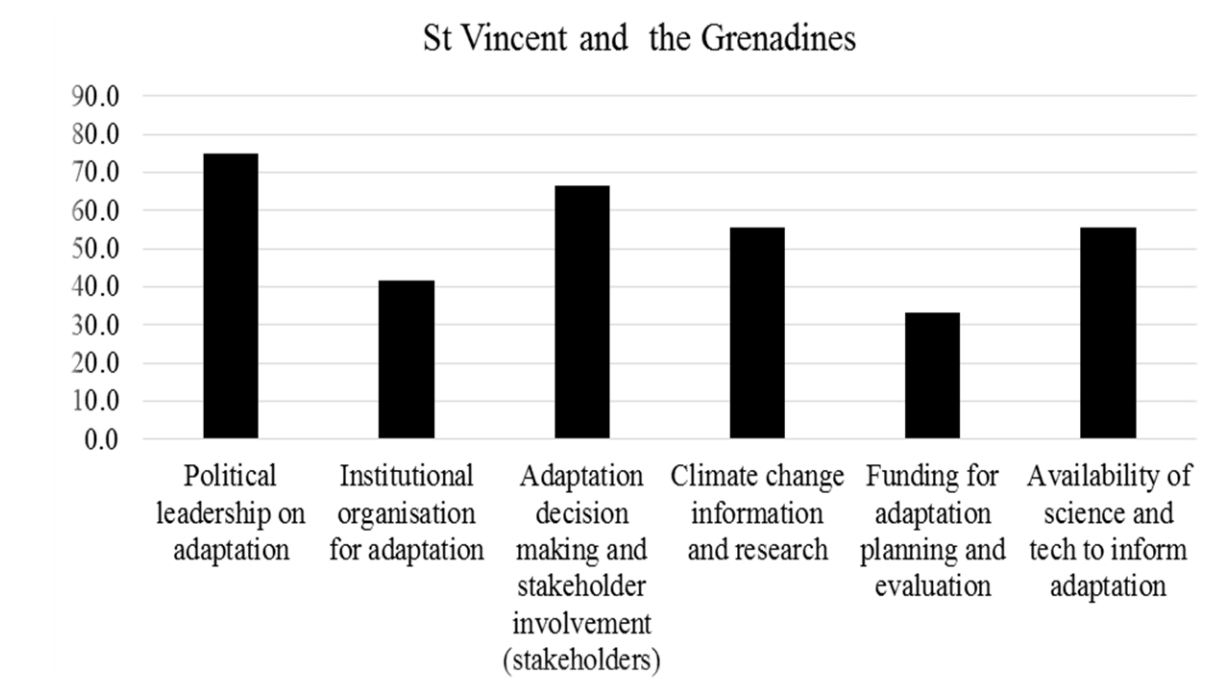


Figure 16: Adaptation readiness index for St. Vincent and the Grenadines

St. Vincent and the Grenadines recorded high adaptation readiness in two components - Political Leadership and Decision Making and Stakeholder Involvement - with scores of 75.0% and 66.7% respectively. Two components - Information and Research and Science and Technology-had moderate adaptation with both components scoring 56%. Institutional Organisation and Funding recorded low adaptation readiness with scores 42% and 33% correspondingly.

The study further suggests that the high readiness for Political Leadership and Decision Making and Stakeholder Involvement is mainly because of the country's Strategic Programme for Climate Resilience and the Disaster Vulnerability Reduction Project. These programs and projects had information on community participation, fisheries and/or fishing communities. The implementation of National Environmental Management Strategies as

well as the National Adaptation Strategy and the National Environmental Action Plan have all contributed to the high scores for political leadership.

Public-partnership with communities and capacity building initiatives are the major attributes that contributed to the high readiness scores in adaptation decision making and stakeholder involvement. A typical example of partnerships identified in this study are the 40 local community disaster committees set up to oversee disaster management in most communities. St. Vincent and the Grenadines' Resettlement Policy Framework is also an important attribute.

St Vincent and the Grenadines had a low readiness score in institutional organisation due to the absence of fishery, community and /or fishing community in their Ministry of Health and the Environment, Inter-Agency Collaborative initiatives, MACC and SPACC projects, among others. However, the country's Ministry of Agriculture, Forestry and Fisheries have community and fisheries elements but this was not enough to score higher on Institutional Organisation.

Funding for adaptation comes from GEF and the World Bank to deal with adaptation in fishing communities, however, this study shows that these funds were not sufficient. Similarly, funds provided by the Pan American Development Foundation and the U.S. Climate Finance do not have sufficient information on fishery, community and /or fishing community, which is imperative for this research.

5.2.13 Adaptation Readiness Index for Trinidad and Tobago

The Republic of Trinidad and Tobago is an island located between the Caribbean Sea and the North Atlantic Ocean. It is bounded at the north-east by Venezuela. It consists of the islands of Trinidad and Tobago. The country is exposed to numerous environmental and climatic hazards including earthquakes, storms, typhoons, and hurricanes which can generate flooding in low lying regions and can cause landslides in hilly areas. The fishery sector in Trinidad and Tobago involves marine fisheries, aquaculture, and inland fisheries. Coastal industrial infrastructure and sensitive ecological regions are exposed to coastal threats, like flooding and sea-level rise.

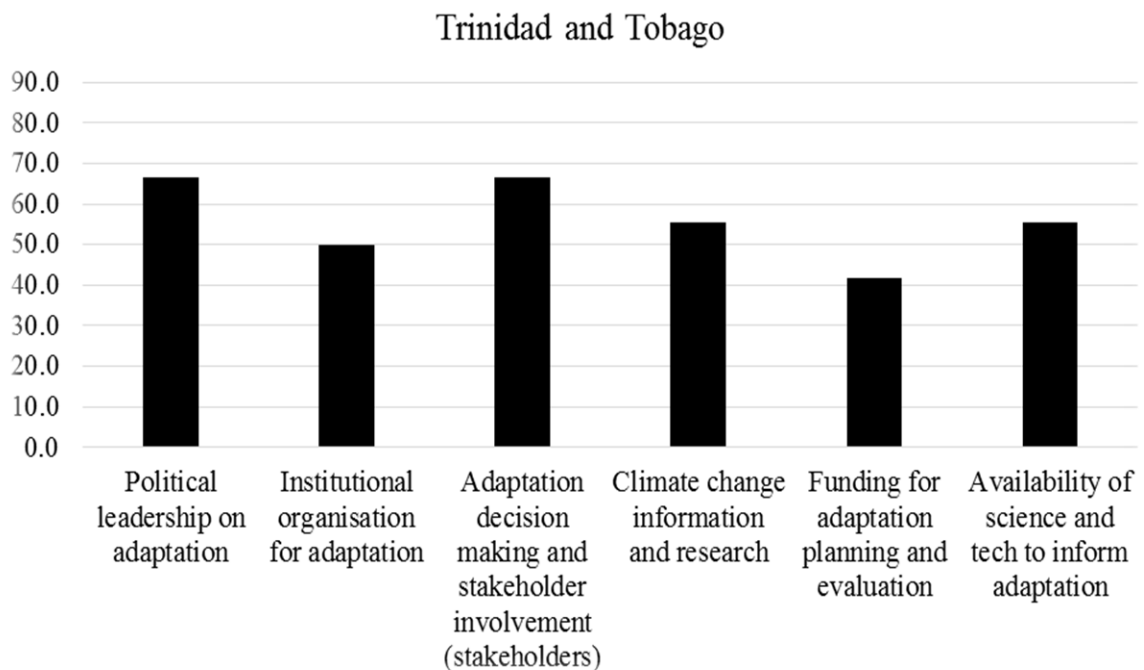


Figure 17: Adaptation readiness for Trinidad and Tobago

Results for Trinidad and Tobago show high adaptation readiness in Political Leadership and Decision Making and Stakeholder Involvement with both components

obtaining a score of 67%. Two components - Information and Research as well as Science and Technology - each obtained 56% while Institutional Organisation had 50%. These scores represent moderate readiness scores in relation to communities, fisheries, and/or fishing communities. Trinidad and Tobago recorded low readiness scores in Funding for Adaptation Planning and Implementation (42%).

The high adaptation readiness documented for Political Leadership is due to the country's National Climate Change Policy which has information on communities and/or fishing communities. A similar trend is also recognised in the initial and second UNFCCC's Communications, Trinidad and Tobago's Fisheries Policy, and National Environmental Policy. Training programs organised by the government and international organisations for community groups also contributed to the success of community participation. For instance, natural resources management programs, and education and awareness creation initiatives aided the restructuring of adaptation capacities in fishing communities in Trinidad and Tobago, hence the high readiness score for Decision Making and Stakeholder involvement.

However, Funding for Adaptation Planning and Implementation had a low adaptation readiness score. There is no record of Trinidad and Tobago's access to Adaptation Funds. Also, from the data compiled, funding from the Cropper Foundation, Inter-American Development Bank, Green Fund, GEF as well as the World Bank did not show explicit attention to access by communities, fisheries and fishing communities. Government budget allocations are limited to general adaptation programs without special attention to local fishing communities.

5.3 Adaptation Readiness Index by Component

This section shows component by component performance and analysis of the set of countries. It focuses on the extent to which countries in the Caribbean are dealing with climate change adaptation in communities, fisheries and fishing communities. This section also shows adaptation readiness differences among countries. For each component discussed below, the main barriers to adaptation readiness were outlined and the reason some countries have more advanced systems of adaptation than others were also examined.

5.3.1 Readiness Index for Political leadership on Adaptation

Political leadership is necessary to create adaptation awareness because climate change cuts across jurisdictions. Robust leadership is critical for initiating the process of adaptation as well as providing strategic and pragmatic direction (Smith et al 2009). Leadership may be in different forms and directions. It could be strategic, facilitative or participative (Egri & Herman, 2000) to promote adaptation. Political leadership as a leadership approach is crucial to achieving adaptation since climate change is highly politicized and sensitive (Agder and Barnett, 2009). Political Leadership has laid the governing framework for better opportunities for effective implementation and evaluation of environment management plans. The summary of the results for political leadership are shown in Figure 1 below:

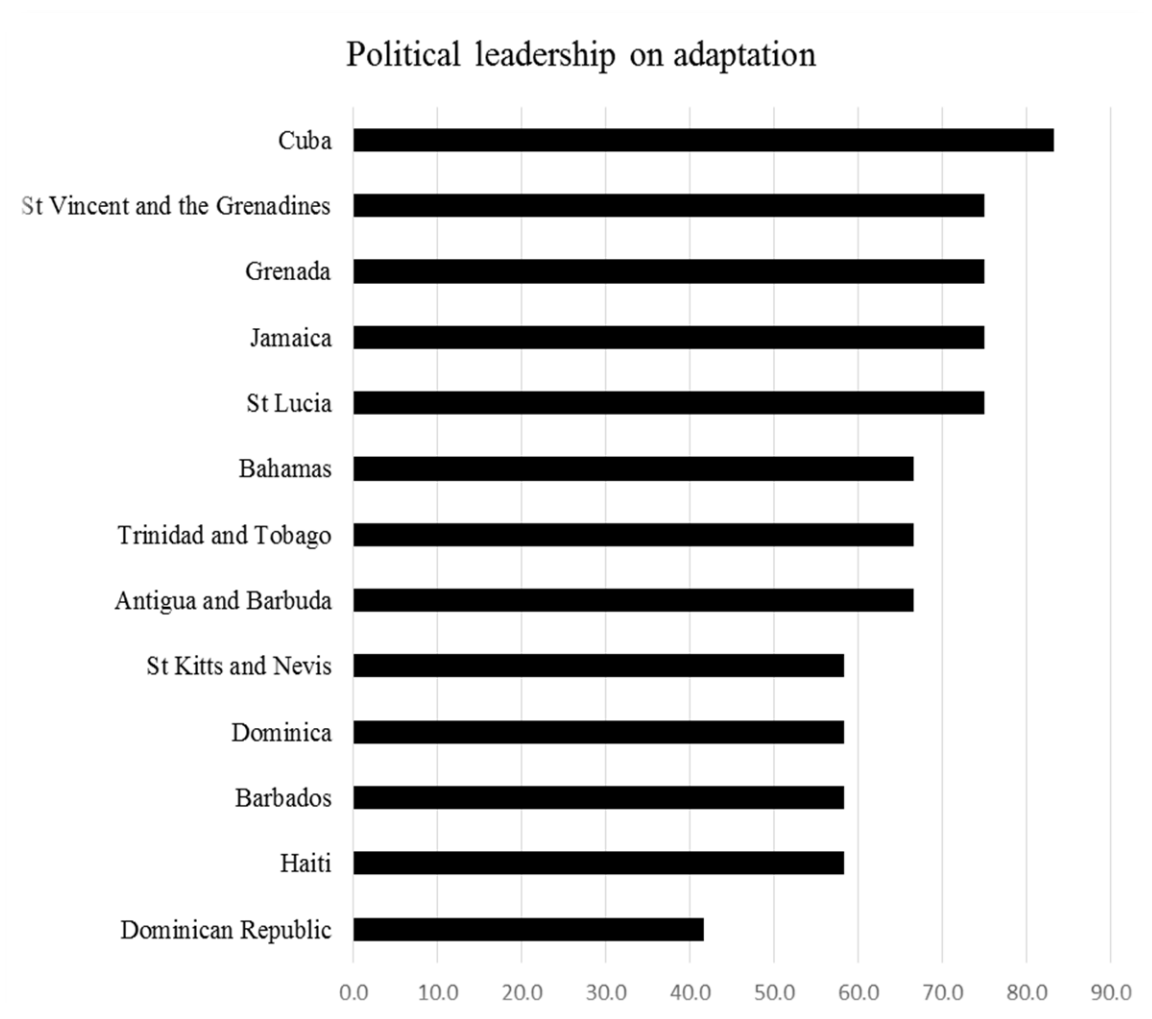


Figure 18: Readiness index for political leadership on adaptation.

As illustrated in Figure 18, eight countries had high adaptation readiness in their Political Leadership on adaptations in relation to communities, fisheries, and/or fishing communities. Cuba had the highest adaptation readiness with a score of 83% followed by Jamaica, St Lucia, Grenada, and St Vincent and the Grenadines with a score of 75% each. Trinidad and Tobago, Bahamas as well as Antigua and Barbuda recorded 67%. Four countries - Barbados, Saint Kitts and Nevis, Dominica and Haiti - had moderate readiness

with a score of 58%. Only one country had low adaptation readiness and that is Dominican Republic with a score of 42%.

The eight island countries with high readiness show sufficient proof of Political Leadership on adaptation through their respective National Climate Change Adaptation Strategy papers and National Environmental Management Strategies, with elements of community's participation. Policies also targeted different sectors of their economies including fishery. The UNFCCC's First and Second National Communications on Climate Change for these countries, which is an attribute for Political Leadership, have been well explored with fisheries and fishing community indications, hence the high and consistent scores. It is notable that countries with high and moderate readiness scores are signatories to both UNFCCC and Kyoto Protocol in addition to agreements with diverse multilateral organisations, as well as having directional leaders (UNFCCC, 2012). Political leadership is one of the most consistent components according to the study.

Dominican Republic however, scored low adaptation readiness (41.7%) in Political Leadership mainly because attributes for Political Leadership, such as national development plans and policies, national acts and legal frameworks, are not fishery, community and/or fishing community focused according to the study. Similarly, there are no data on any national climate change strategy; even though they have a comprehensive national climate compatible development plan there is no evidence of elements of fishery, community and fishing community. It rather targeted other sectors like energy, transport, waste management, tourism, as well as forestry sectors (Gov't of Dominica Republic, 2012).

5.3.2 Readiness Index for Institutional Organisation for Adaptation

Institutions provide essential structures necessary for human interactions and activities for adaptation (Agrawal, 2010). Institutions could be in the form of political or administrative depending on structures and characteristics of a given organisation. Over the past years, institutions have laid the governing framework for opportunities in implementing and evaluating successful adaptation plans and policies (Füssel, 2007). National and local governments have played crucial roles to build effective institutional readiness for adaptation. Institutions should provide proficient and operative governing bodies that support adaptation planning and policy (Adger et al, 2010). Institutional capacity of countries in this study was reviewed based on the number of ministries, departments, agencies and units. The outcomes for institutional organisation for adaptation is shown on Figure 19 below:

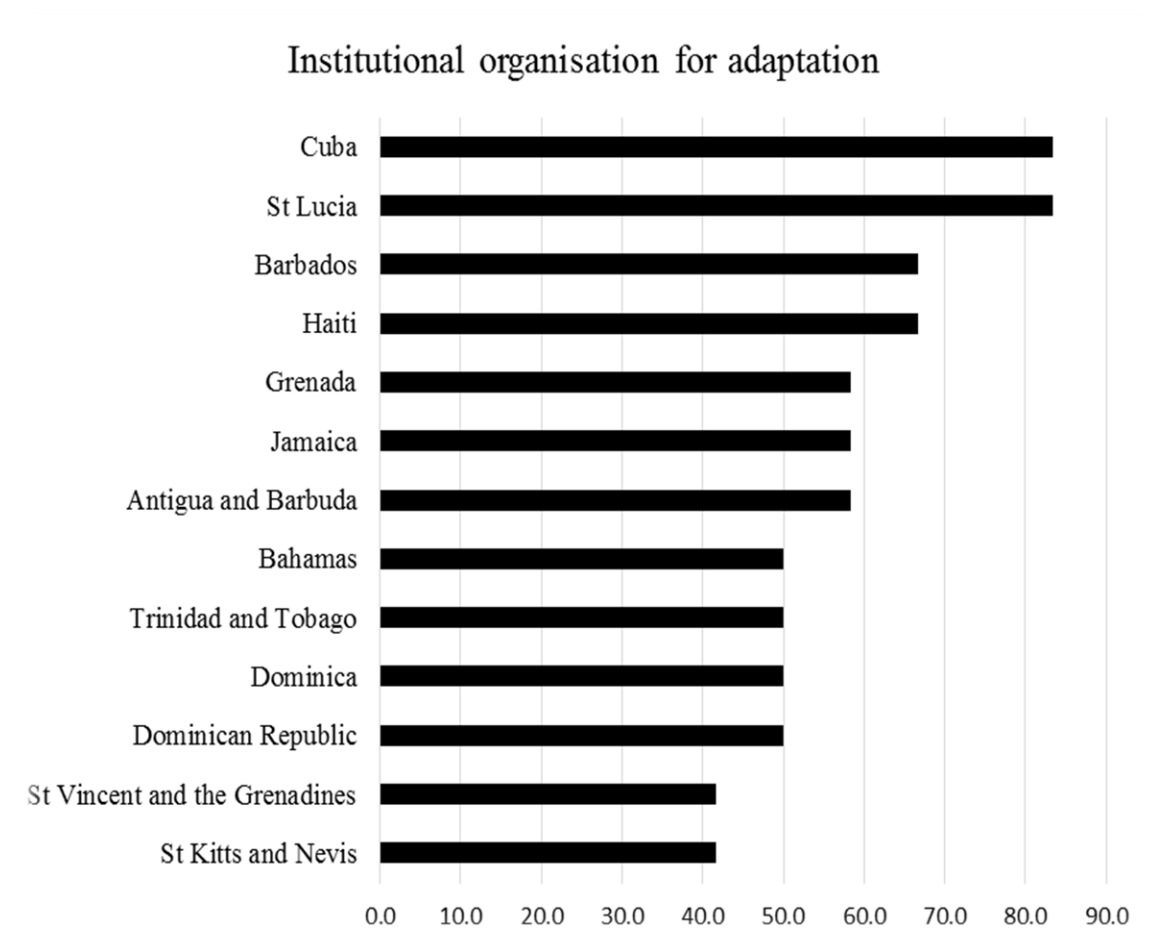


Figure 19: Readiness index for institutional organisation for adaptation

The results suggest that four countries - Cuba, St Lucia, Barbados and Haiti - had high readiness on institutional organisation for adaptation focused on communities, fisheries and fishing communities. St Lucia and Cuba recorded 83% each, while Barbados and Haiti both recorded 67%. Results for institutional organisation further points out seven countries as having moderate adaptation readiness. Their scores ranged from 50% to 58%. However, two countries - St Vincent and the Grenadines and St Kitts and Nevis - had low readiness in their Institutional Organisation for Adaptation, both with scores of 42%.

The four countries with high readiness exhibited concrete evidence on establishing and restructuring of local infrastructures, ministries, departments and units for adaptation initiatives. Data on well-developed inter-agency and cross sectoral partnerships, as well as climate change working groups had information on communities, fisheries and fishing communities. Moreover, fisheries have contributed immensely to the GDP in the respective economies of Cuba, St Lucia, Barbados and Haiti. For instance, fisheries contributed a combined amount of about \$129.1m to the economy of Cuba and Haiti based on 2012 estimates (World Bank, 2012).

Analysis of results for Institutional Organisation further point out that seven countries were identified as having moderate readiness. Saint Kitts and Nevis in addition to Saint Vincent and the Grenadines had low readiness scores in their Institutional Organisation for Adaptation because they did not exhibit adequate information on institutional reforms necessary for adaptation. It is important to note that the two countries with low adaptation readiness also contributed the least to fisheries with a total contribution of \$10.8m to their respective economies (FAO, 2007). They also have the lowest population in the Caribbean region with estimates less than 150,000 in 2014 (UN Database, 2013).

5.3.3 Readiness Index for Adaptation Decision Making and Stakeholder Involvement

Adaptation Decision Making and Stakeholder Involvement by local participants reflect community needs and principles. As such, engaging local stakeholders support a capable adaptation implementation, which is important in assessing adaptation strategies. Involvement is also acknowledged as good governance process (Santiso, 2001). Decision

making in the context of climate uncertainties is relevant since adaptation has human elements, factors and actions.

Due to these, several decision making frameworks and stakeholder approaches have emerged. For instance, the informative participation and consultative participation approaches have seen local communities contribute their expertise to policy making (Green & Hunton-Clarke, 2003). Stakeholders in the private sector, civil society, and the general public have been active in climate change planning and policy development. Figure 20 below summarises the results of adaptation readiness and stakeholder involvement.

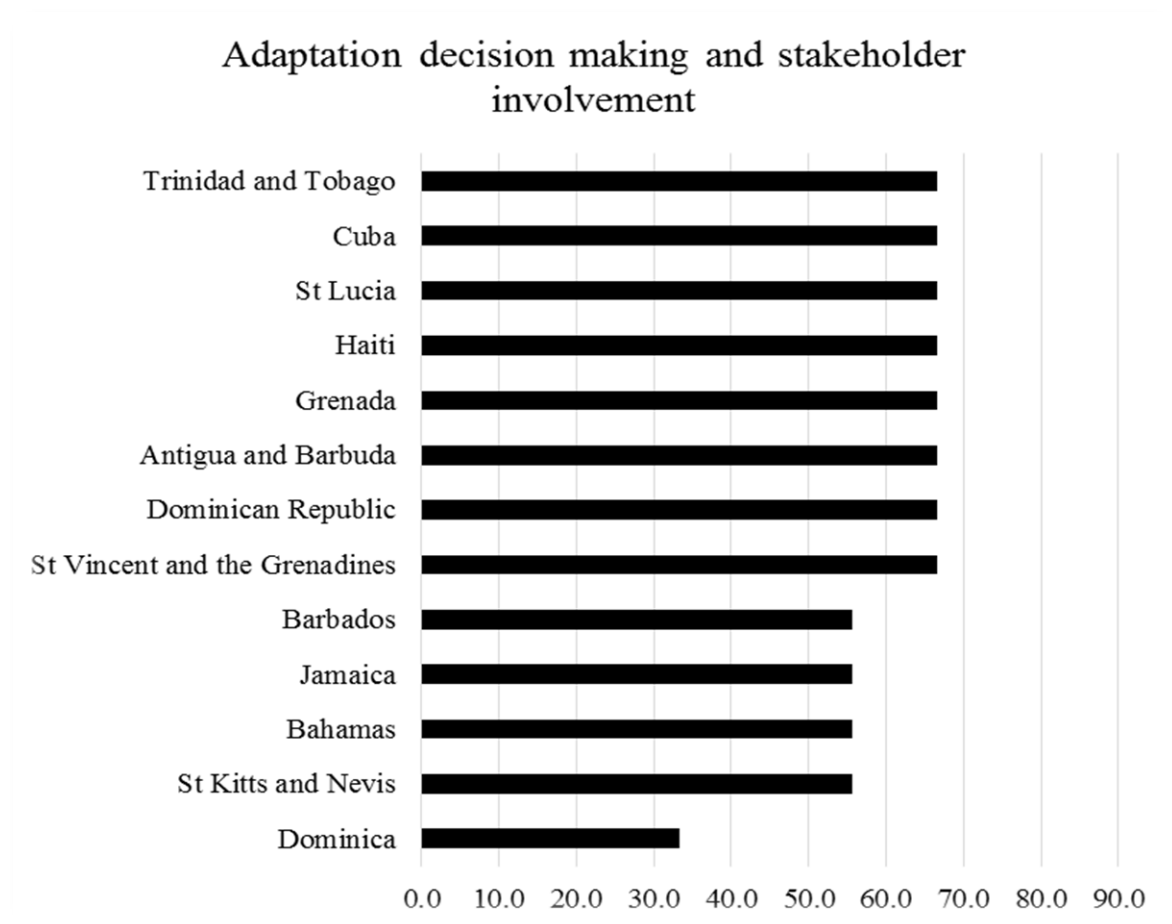


Figure 20: Readiness index for adaptation decision making and stakeholder involvement

Eight out of thirteen countries recorded 67% representing high adaptation readiness in Adaptation Decision Making and Involvement. Four countries - Barbados, Jamaica, Bahamas and St Kitts and Nevis - obtained a moderate readiness score of 56% while Dominica obtained 33% signifying a low adaptation readiness score. Dominica is the only country with a low score for this component. It is significant to note that adaptation decision making and stakeholder involvement represents one of the most consistent components in the study because of the number of high readiness scores recorded by countries.

The high adaptation readiness by these eight countries was based on the identification of a number of public awareness creation and engagement plans for climate change adaptation. These programs were organised by international development organisations such as the UNEP, UNDP, and GEF. Other programs were also designed by other institutions such as Inter-American Development Bank (IDB) and the Caribbean Regional Fisheries Mechanism (CRFM). Programs from the above institutions have references to fisheries, communities and/or fishing communities.

Besides, projects and programs from The Caribbean Community Climate Change Centre (CCCCC), Caribbean Planning for Adaptation to Climate Change (CPACC) as well as Mainstreaming Adaptation to Climate Change (MACC) had proof of communities, fisheries, and/or fishing community involvement (CARICOM, 2012). Some examples of programs and projects undertaken by the above institutions include coral reef monitoring for climate change (Bahamas and Jamaica), coastal vulnerability and risk assessment

(Barbados and Grenada), and economic valuation of coastal and marine resources (Dominica, Saint Lucia, and Trinidad and Tobago) (CCCCC, 2012).

However, Dominica scored low mainly because of the absence of non-state actors' involvement in addition to participation and educational programs on climate change. As well, this study did not identify national assessments, an attribute that is necessary for the stakeholder involvement component due to its assistance in enhancing local knowledge. This research show a pilot program for Climate Resilience but this did not have enough proof of attention to fisheries, communities and/or fishing communities. Dominica is discussed in details in subsequent sections of the research.

5.3.4 Readiness Index for Climate Change Information and Research

Research and information is vital to inform climate change adaptation action, and results from different climate research have implications for policy and project enactments (Moss et al., 2010). There has been different arguments on adaptation research and usable science. While some climate scientists contend the need for climate change adaptation projections through science and research, others consider these projections to be overstated (Ding et al., 2001). However, in order for adaptation planning to be efficient, it is vital for climate change information to be available for easy accessibility to governments, stakeholders, as well as the general public.

Also, the science of climate change is multidisciplinary involving natural and social sciences and geomatics, therefore information sharing and data support is significant to adaptation planning. (Burroughs, 2007). In most countries many research institutions have been established to augment adaptation and to provide the required tools for understanding

the needs of society, to be able to identify adaptation options and to help understand how adaptation can be promoted, implemented, monitored and evaluated (Meehl et al., 2007).

The results for this component are shown below:

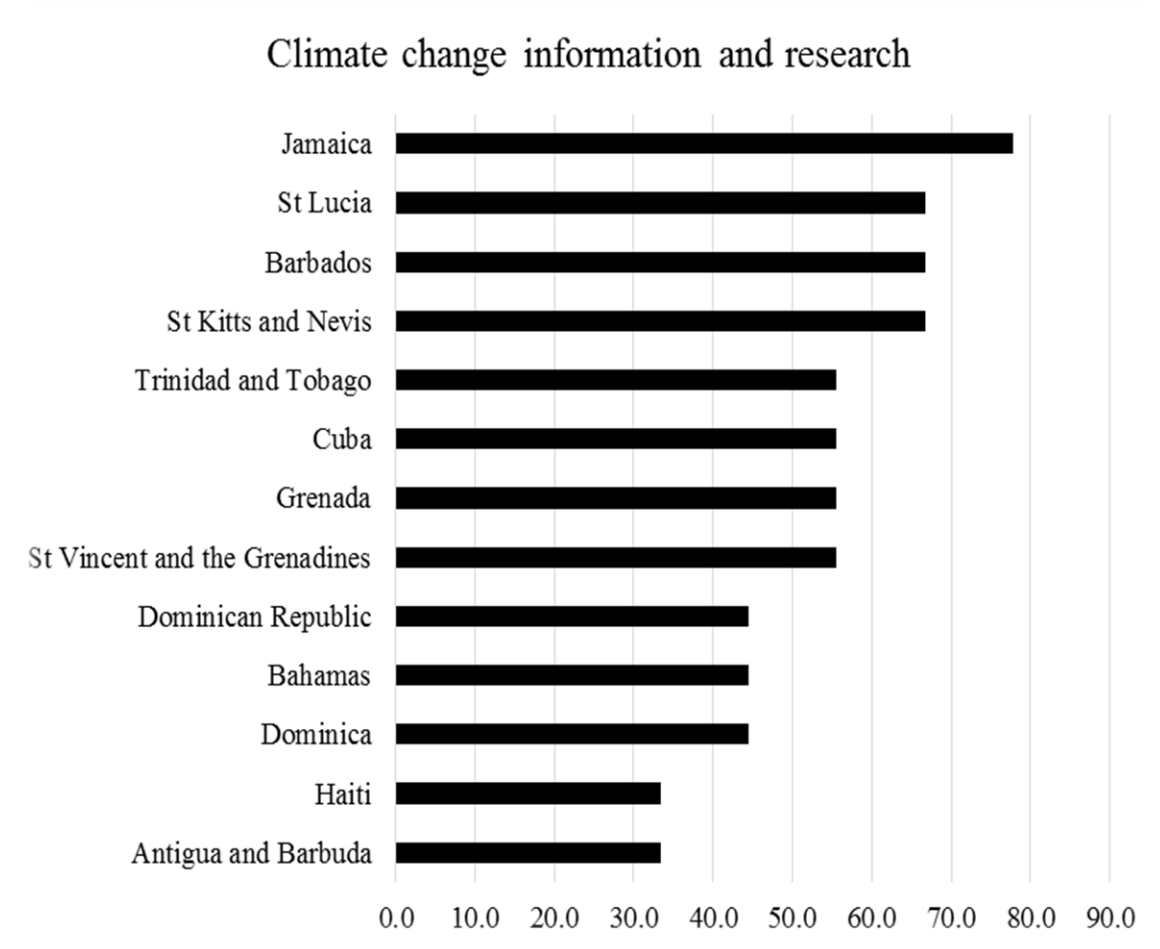


Figure 21: Readiness index for climate change information and research

The outcome of this study reveals that four countries - Jamaica, St Lucia, Barbados, and St Kitts and Nevis - had high adaptation readiness scores for climate information and research component. Jamaica had the highest score of 78% while St Lucia, Barbados, and St Kitts and Nevis scored 67% each. Four countries - Cuba, Grenada, Trinidad and Tobago along with St Vincent and the Grenadines- have moderate adaptation readiness, all with

scores of 56%. The five remaining countries Dominican Republic, Bahamas, Dominica, Haiti, and Antigua and Barbuda all have low adaptation readiness with a score ranging between 33% and 44%.

Countries with high adaptation readiness correspondingly have several research organisations which are keen on research that deals with fisheries, communities and fishing communities. For instance, Jamaica, St Vincent and the Grenadines, and Barbados are the homes of lead research institutions such as CARIBSAVE, The University of West Indies, Caribbean Maritime Institute (CMI), and Caribbean Regional Fisheries Mechanism, among others.

Also, countries with low adaptation readiness did not demonstrate adequate climate information and research necessary for adaptation with fishery, community and fishing community features. For example, Dominica and Antigua and Barbuda do not have universities or research institutions necessary for climate research. Climate information and research is the second worst performing component in the study.

5.3.5 Readiness Index for Funding for Adaptation Planning and Evaluation

Funding is mandatory for adaptation to be operational and sustainable (Smith et al, 2011). It may come from different sources – government, private industry, foundations, and professional organisations, along with international organisations. Since government funding is mostly insufficient, there is the need for specific committed adaptation funds accessible to countries. It is accepted that funding needs to be incorporated into a baseline funding for it to be capable (Bals & Butzengeiger, 2006). In most developing countries, funding comes from national budgets, private sector contributions, foundations, and

international funding resources. Similarly, funding mostly comes from international resources, such as Adaptation Fund, GEF Special Climate Change Fund and Green Climate Fund from UNFCCC (Bueno, 2008). The results for adaptation funding for this study are represented below:

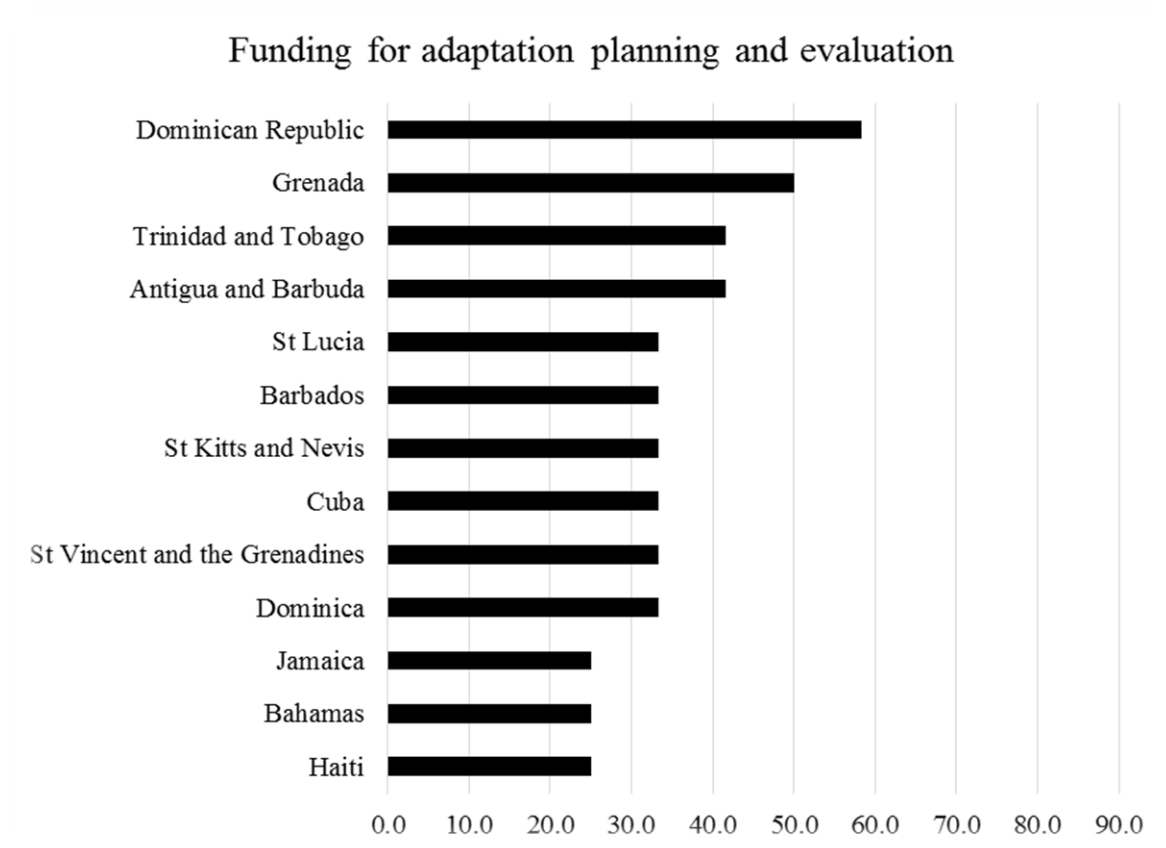


Figure 22. Readiness index for funding for adaptation planning and evaluation

According to this study, Funding for Adaptation Planning and Evaluating is the component with the lowest scores. From Figure 22 above, no country recorded a high readiness score. Only two countries, Dominican Republic (58%) and Grenada (50%), demonstrated moderate adaptation readiness. The rest of the eleven countries have low adaptation readiness. Antigua and Barbuda and Trinidad and Tobago scored 42% each, six

countries - Dominica, Cuba, St Vincent and Grenadines, St Lucia, Barbados, St Kitts and Nevis - scored 33%, while Jamaica, Bahamas and Haiti all scored 25% each.

Interestingly, Bahamas, the richest country in the sub region, scored very low (25%) in funding while Dominican Republic, one of the poorest countries, has the highest score. Dominican Republic and Grenada demonstrated evidence of funding through their national budgets and from external sources. For example, \$USD1m from Dominican Republic's national budget was allocated for training teachers in climate change programs in local communities (Gov't of Dominican Republic, 2013).

Most of the countries scored low because of the absence of fisheries and fishing communities in their environmental planning budgets. The overall result for this study shows that access to funding for adaptation has been challenging in the region. This confirms conclusions of Shardal & Samuel (2008) and Parry (2009), that climate change funding access to developing countries have been on the low side.

The literature search for this study also came to an agreement that although funding has been apportioned to different countries from GEF funds, the Green fund, grants and loans from IDB, UNDP, and USAID, among others, there are no records of the funds accessibility to communities and specifically fishing communities. For example, annual budgets of countries such as Jamaica, Grenada, and Trinidad and Tobago have also assigned funds for climate change adaptation but there are no distinct references to fishery, community and fishing communities (See Appendix).

5.3.6 Readiness Index for Science and Technology to Inform Adaptation

Science and technology assessment has been underscored in several areas of adaptation preparation and intervention. For instance, King (2004) contend that different forms of science and technology are required for adaptation. The hard forms of technology such as irrigation and drought resistance needs are as important as soft technologies, such as crop rotation and climate insurance, or there could be a combination of the two (Scott, 2005). Local radar for tracking storms and the link with international radar to fine-tune tracking in local communities has been the main types of usable technology in most countries in the global south.

Other forms of technologies are coastal protection technologies, such as sea defence walls, but they are seen to be very expensive and can have damaging side effects (Klein et al, 2001). Currently, rain water harvesting, which involves the collection of water for different uses, has been seen as a cost effective technology for adaptation in communities around the world. The breakdown of the result for Science and technology is illustrated in Figure 23 below:

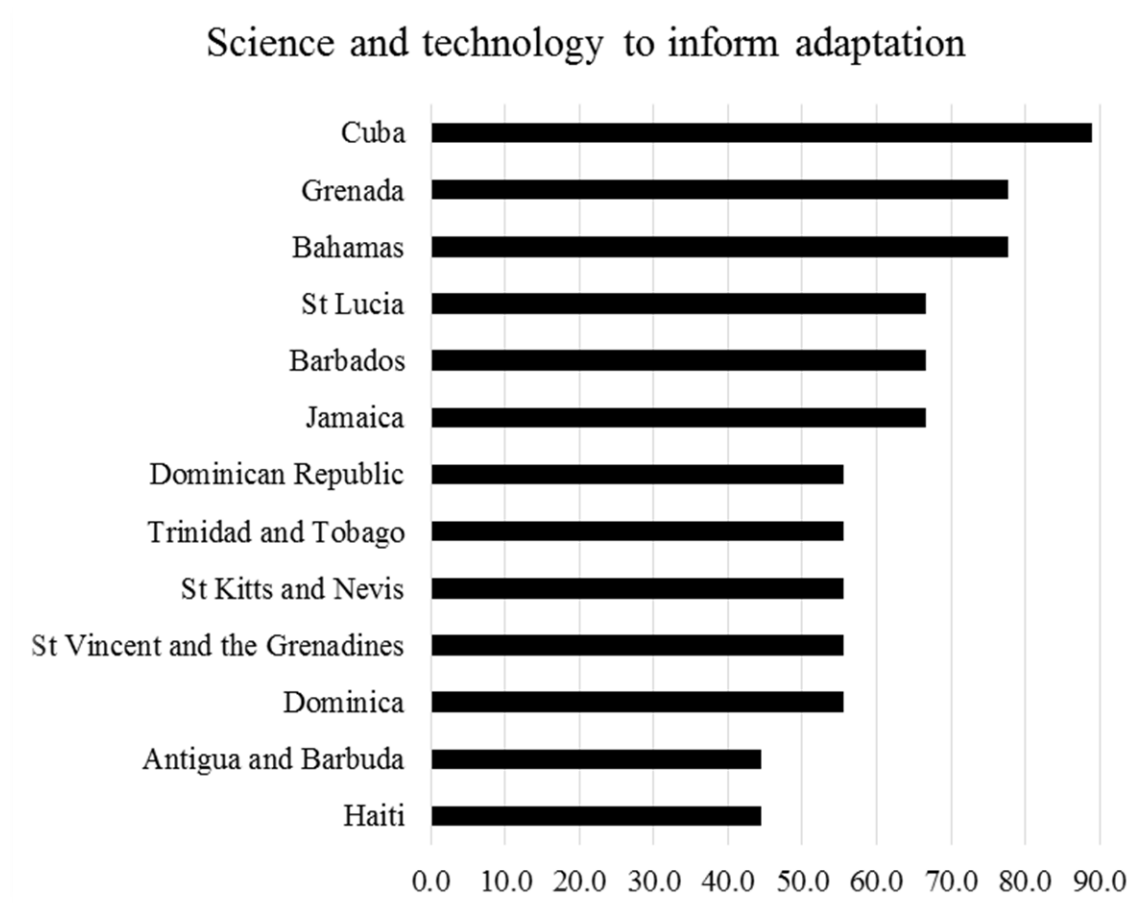


Figure 23: Readiness index for science and technology to inform adaptation

The results show that six countries had high adaptation readiness in the category of Science and Technology. Cuba had the highest score of 89%, Grenada and Bahamas scored 78% each, and Jamaica, Barbados, Saint Lucia have scores of 67%. Five countries had moderate readiness with scores of 56% each. Two countries, Antigua and Barbuda, and Haiti had low adaptation readiness with respective scores of 44%.

Countries with high adaptation readiness showed adequate information on early warning systems and national technology needs assessment reports with fisheries, communities and /or fishing communities focused. The most common forms of science and

technology demonstrated in this research are rain water harvesting, aquaculture and irrigation projects. The result further suggests that Cuba, Bahamas and Grenada, which are the top three ranked countries for this component, also have seen fisheries contributing to their (Cuba, Bahamas and Grenada) respective economies. For example fisheries have contributed \$92m to the economy of Cuba, \$83m to Bahamas and \$25m to Grenada (based on FAO 2012 estimates).

Technologies such as early warning systems provide proactive and rapid responses to climate related disasters and it is regarded as an integrated and comprehensive solution to climate change (Dakos et al, 2008). The results compliment the idea that science and technology for adaptation information facilitates early mobilisation of communities and relevant stakeholders (King, 2004).

5.4 Synthesis of Results

The study indicated significant differences in adaptation readiness across the 13 island countries in the Caribbean. Only three countries - Cuba, Saint Lucia, and Grenada - were identified to have high adaptation readiness in relation to communities, fisheries, and/or fishing communities (scores above 60% as defined in the methodology). They obtained 69%, 65% and 64% respectively. These three countries showed significant evidence of adaptation readiness measures with considerations of communities, fisheries, and/or fishing communities. For instance, Cuba's National Commission on Climate Change and National Environmental Strategy had adequate information on capacity building, education and public awareness in selected communities as well as on fisheries (Gobierno de Cuba, 2012).

Saint Lucia's National Climate Change Policy and Adaptation Plan in addition to workshops on mainstreaming climate change into national development planning and national budgetary process, had discussions of communities, fisheries and fishing communities (Gov't of St. Lucia, 2013). Similarly, Grenada demonstrated discussions on communities, fisheries and fishing communities in its Integrated Climate Change Adaptation Strategy (Gov't of Grenada, 2013). These factors account for the high readiness scores in adaptation. Scores and performances of individual countries are illustrated in Table 3 below: It shows that deep brown, brown and light brown coded marks represent high, medium and low adaptation readiness.

Table 3: Distribution of adaptation readiness Index obtained by countries.

		COUNTRIES												
		Antigua and Barbuda	Bahamas	Barbados	Cuba	Dominica	Dominican Republic	Grenada	Haiti	Jamaica	St Kitts and Nevis	St Lucia	St Vincent and the Grenadines	Trinidad and Tobago
COMPONENTS	Political leadership on adaptation	67	67	58	83	58	42	75	58	75	58	75	75	67
	Institutional organisation for adaptation	58	50	67	83	50	50	58	67	58	42	83	42	50
	Adaptation decision making and stakeholder involvement (Stakeholders)	67	56	56	67	33	67	67	67	56	56	67	67	67
	Climate change information and research	33	44	67	56	44	44	56	33	78	67	67	56	56
	Funding for adaptation planning and evaluation	42	25	33	33	33	58	50	25	25	33	33	33	42
	Availability of science and tech to inform adaptation	44	78	67	89	56	56	78	44	67	56	67	56	56
Average Score (%)		52%	53%	58%	69%	46%	53%	64%	49%	60%	52%	65%	55%	56%

The study further demonstrates that Dominica and Haiti are countries with the lowest adaptation readiness (scores below 40% as shown in the methodology). They scored 46% and 49% respectively (See Table 3). The search did not reveal anything related to the Government of Dominica's UNFCCC's Adaptation Fund, Green Climate Fund (GCF), and Climate Investment Fund necessary to finance adaptation projects, hence the low readiness scores. Also, information on Dominica did not show any evidence on climate change education, awareness creation and curriculum development programs. Likewise, Haiti's

National Climate Change Steering Committee did not reveal any information related to communities, fisheries, and fishing communities. These countries are discussed in details in subsequent sections of this research.

Eight countries were categorized as having moderate adaptation readiness scores. They are Antigua and Barbuda, Bahamas, Barbados, Dominican Republic, Jamaica, St Kitts and Nevis, St Vincent and Grenadines, Trinidad and Tobago. In all, these countries obtained an average score of 55%, which explained the moderate degree at which climate change policy approaches are dealing with communities, fisheries and/or fishing communities. Twelve countries performed well on both Political Leadership and Institutional Organisation but did not demonstrate a high enough level of Climate Change Research and Information as well as Funding for adaptation planning.

This study also recognised that Cuba, Grenada and St Lucia are leading the way in preparing for adaptation in communities and fishing communities due to their comprehensive and integrated plans that address adaptation in the fishery sector. Unfortunately, other countries, especially Haiti and Dominica are lagging or are yet to formally address climate change preparedness in this sector. For example, the nationwide vulnerability assessment to determine the potential impacts of climate change in Grenada can be emulated in communities in Dominica with similar GDP per capita and population. Equally, the 'Action Plan on Adaptation to Climate Change' developed in Cuba with fishery and community focus can be done in Bahamas which has a 'National Climate Change Policy' but not too much was focused on fisheries and fishing communities.

Adaptation readiness in communities, fisheries and fishing communities also differ from one island country to another in this study. This research showed that some countries are more prepared and advanced than others in dealing with adaptation. Whereas, Bahamas, Grenada, Jamaica and Dominican Republic had both first and second UNFCCC's national communications, Haiti, St Kitts and Nevis and St Vincent and the Grenadines are yet to come out with their second communications. Also, Bahamas, Barbados, Cuba and Grenada had outlined comprehensive and integrated climate change policies with information on communities and fisheries while data and materials gathered for Antigua and Barbuda, Dominica, and Dominican Republic did not show sufficient information on climate change policies.

Furthermore, the Government of Jamaica has incorporated fisheries and climate change into the Ministry of Agriculture (now Ministry of Agriculture and Fisheries) and Climate Change has been added to the Ministry of Water, Land and Environment (now the Ministry of Water, Land, Environment and Climate Change). These changes were done to show special responsibility to fisheries and climate change. Besides, climate change adaptation readiness differs between countries in this study. While some countries like St Kitts and Nevis, Antigua and Barbuda and Grenada had shown more advanced adaptation readiness methods, such as early warning systems, irrigation facilities and rainwater harvesting, most of these countries are missing out on communities, fisheries and/or fishing community inclusion.

The study further suggested that Cuba, Saint Lucia and Grenada had generally addressed communities, fisheries, and fishing communities in their adaptation programs

and policies. But Bahamas, Jamaica and Barbados even though having adequate adaptation policies and projects, are missing out on communities, fisheries, and/or fishing communities. It is important to note that all countries had demonstrated the existence of national acts and legal frameworks on climate change and fishery based on the in literature collected and compiled. Ministries responsible for environment and fisheries was also well documented and well represented in this study. **Figure 24** below shows the performance of countries represented geographically.



Figure 24: shows the performance of countries represented geographically. Deep brown colors show high adaptation readiness while light brown show low adaptation readiness (See Legend).

5.5 Connecting Adaptation Readiness Average Scores and Socio-Economic Indices

Socio-economic analyses are important tools used by governments and stakeholders for budgeting, planning, evaluating and researching. This section of the study shows the interaction, if any, between adaptation readiness scores and several socio-economic measures – Human Development Index (HDI), Gross Domestic Product (GDP) per capita, fishery as a percentage of GDP, and fishery production. The table below displays important variables for selected island countries in the Caribbean.

Table 4: Relevant socio-economic data based on 2012 estimates

Countries	HDI Value	Fishery as % of GDP	GDP Per Capita	Fishery production Per Tonnes (2007)
Grenada	0.743	3.01%	7,418	4172
Dominica	0.716	2.58%	6,958	1596
Antigua and Barbuda	0.773	1.11%	13,207	3500
Bahamas	0.788	1.03%	21,624	9074
St Lucia	0.715	1.00%	7,289	4753
St Vincent and the Grenadines	0.717	0.96%	6,349	1711
St Kitts and Nevis	0.749	0.51%	14,267	1495
Haiti	0.469	0.44%	706	21342
Barbados	0.776	0.35%	16,004	11090
Jamaica	0.715	0.14%	5,343	14281
Cuba	0.813	0.14%	6,301	73213
Trinidad and Tobago	0.765	0.05%	17,365	8700
Dominican Republic	0.698	0.02%	5,731	92531

Source: World Bank (2012), FAO (2007), UN database (2013)

The results above show the values of HDI, GDP per capita, and fishery as a percentage of GDP as well as fishery production of selected island countries in the Caribbean. HDI is a combined index of education, life expectancy, and income indices used to rank countries. HDI, according to development scholars, shows progressive levels of human development (Seth & Villar, 2014). GDP per capita is gross domestic product divided by population. “GDP per Capita is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products” (World Bank, 2013). Fishery as a percentage of GDP indicates the contribution of fisheries to the GDP of a country while fishery production per tonne shows the volume of fish production of a particular country. Detailed analysis of each socio-economic indicator and climate change adaptation readiness average scores is shown in the next sections of this chapter.

5.4.1 Adaptation Readiness Average Scores and HDI

Short and long-term effects of climate change may hinder capabilities of people to live healthy lives and also to have a worthy standard of living. Climate change does not only threaten efforts by developing countries to attain the Millennium Development Goals (MDGs) but could also lead to major setbacks in income, health and education outcomes (UNDP, 2009). Recent HDI reports on climate change stated that there will be increased inequalities among people particularly in developing countries (Rao, Riahi & Grubler, 2014). The diagram below shows adaptation readiness average scores and HDIs.

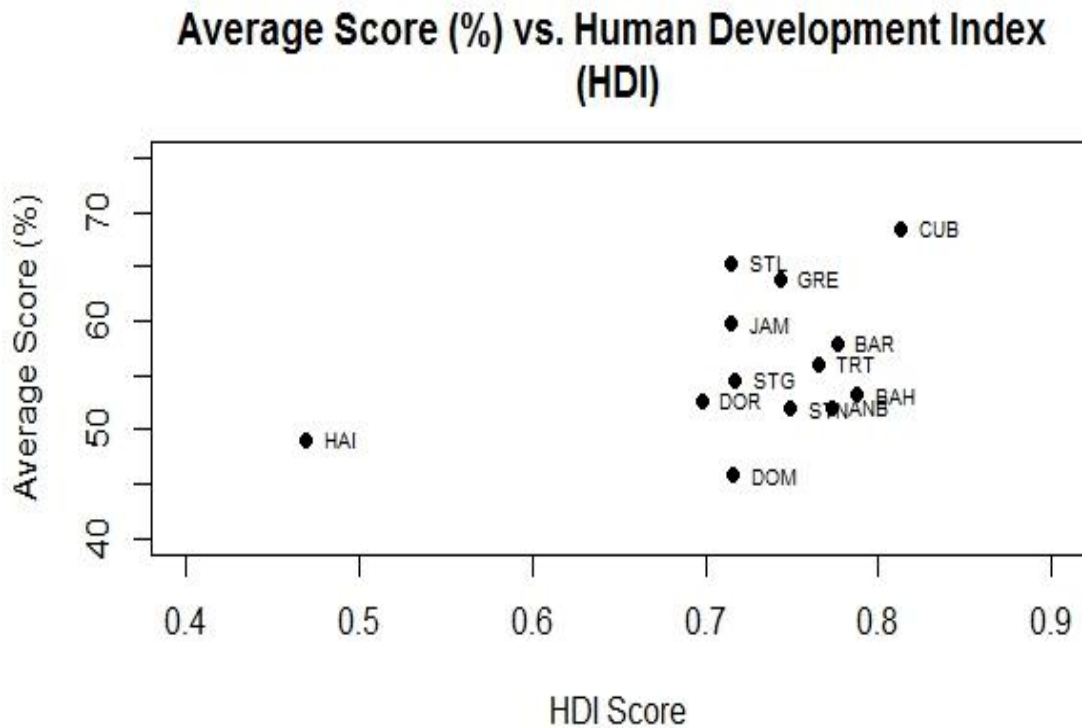


Figure 25: Adaptation readiness average score versus HDI, by country

Eleven countries with high Human Development Indices (HDI) also had high and moderate adaptation readiness scores in relation to communities, fisheries and specifically fishing communities. Cuba, Bahamas, Barbados, and Antigua and Barbuda, the countries with the highest ranked HDIs, recorded high and moderate readiness scores, while Saint Lucia, Jamaica, Dominican Republic and Haiti, the lowest ranked countries, obtained low and moderate readiness scores. Specifically, findings for this research show an interesting trend between Cuba and Haiti. For instance, Cuba, the highest ranked HDI country (1st position among the countries studied), is also the country with the overall highest adaptation readiness score (69%). Similarly, Haiti, the lowest ranked country in terms of HDIs, had the second overall lowest adaptation readiness score (49%). (Refer to the

diagram above). The average readiness score was used because it summarises a large amount of data for various countries into a single value. The average score dealt with the readiness value that is a typical illustration of numbers obtained by a country.

However, this research observed that two countries - Saint Lucia and Grenada - recorded high readiness scores but did not demonstrate high rankings in their HDIs. Interestingly, Dominica, with a relatively good HDI value according to UNDP standards, had the lowest adaptation readiness average scores in relation to fisheries, communities and specifically fishing communities. There is a little connection between HDI and readiness which indicates but not when Cuba and Haiti. When these two countries are left out, there will not be a connection. This is mainly because HDI looks at broader indicators such as education, per capita income and life expectancy. This has little connection with fisheries and communities, hence no connection when Haiti and Cuna are excluded.

5.3.2 Adaptation Readiness Index Average Score and GDP Per Capita

Climate change already has significant economic costs in different parts of the world including the island countries of the Caribbean (Peterson et al., 2002). These economic costs impact on climate-sensitive areas such as forestry, agriculture, tourism and fisheries. Findings from Mendelsohn et al. (2006) revealed that climate change will have distributional influences across countries and their per capita incomes. Their study also projected that poor countries will suffer the majority of the damages whereas rich countries will have adequate adaptation capabilities. GDP per capita and average scores are compared on Figure 26 below:

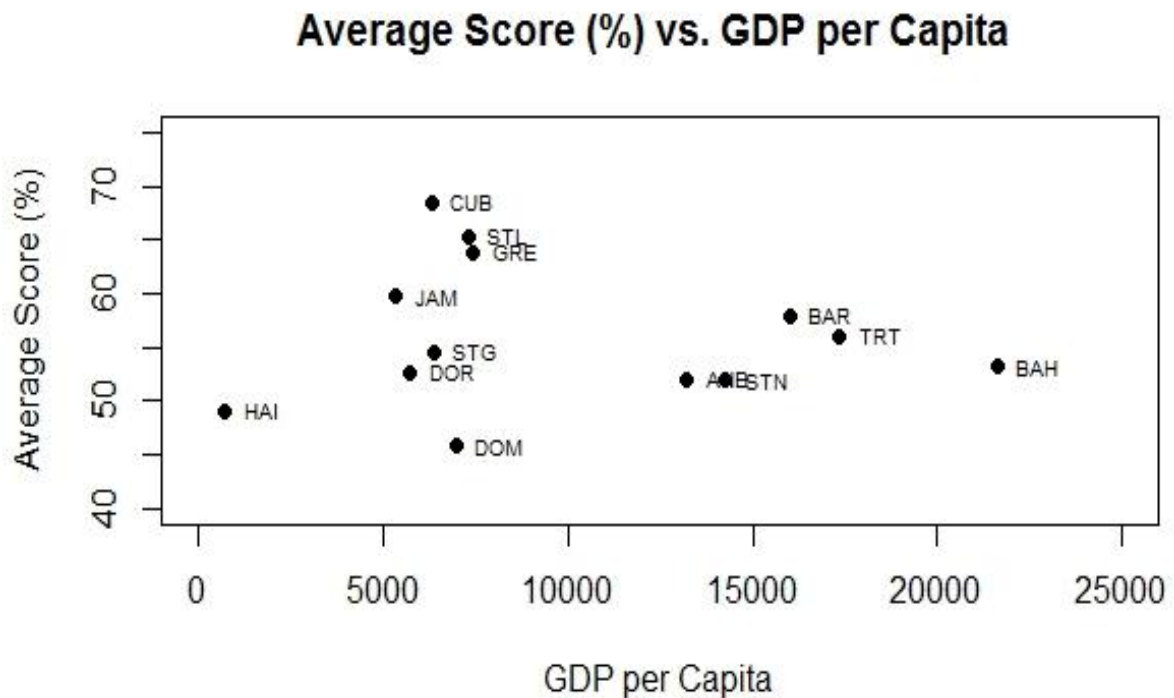


Figure 26: Adaptation readiness average score versus GDP per capita, by country

The study further indicated that Cuba, with GDP per capita of USD\$ 6,301, also recorded the highest adaptation readiness score of 69% in relation to communities, fisheries, and specifically fishing communities. Saint Lucia and Grenada, with GDP per capita of USD\$ 7, 200 and USD\$ 7, 418 respectively, had moderate adaptation readiness scores. According to the UN standards, GDP per capita, with values under USD\$ 10,000 are low, hence the scores and analysis indicated GDP per capita does not have influence on adaptation readiness scores in this study. Moreover, Bahamas with GDP per capita of USD\$ 21,624 recorded a moderate adaptation readiness score with a country average readiness

score of 53%. Haiti, with a poor GDP per capita - USD\$ 706 - also performed poorly based on adaptation readiness scores.

The three richest countries in the region - Bahamas, Trinidad and Tobago, and Barbados -, based on their GDP per capita had moderate readiness scores. In all, these results show that rich countries in the island countries do not necessarily have adequate adaptation readiness, in relation to communities, fisheries and/or fishing communities. The study further points out that countries may be rich, but funding for adaptation programs may not necessarily be available or accessible to communities. For instance, findings for this study did not have enough information on how funds are distributed in terms of different sectors such as fisheries and fishing communities.

5.4.3 Adaptation Readiness Index Average Score and the Fishery (% of GDP)

Fisheries and aquaculture activities make critical contributions to socio-economic development in the areas of employment and income, with over 41 million people worldwide working in fish production, and nearly a third of fishery production in developing countries is intended for exports. Fisheries contributions to the economies of countries in the Caribbean is small compared to tourism and agriculture, but future estimates specify that the majority of the fisheries will be affected by climate change (Allison, et al, 2009). (See literature review for detailed description). The diagram below shows the percentage of fishery contribution to the economies of selected Island countries in the Caribbean and their adaptation readiness average scores.

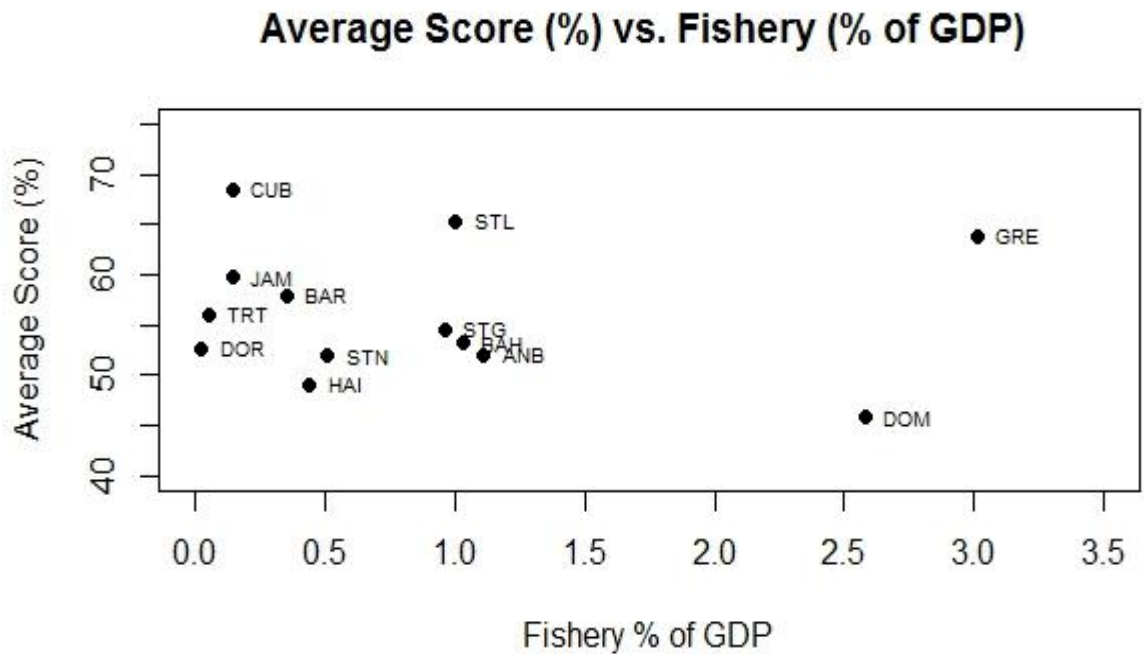


Figure 27: Adaptation readiness average score versus fishery % of GDP, by country

The Figure 27 above shows the relationship between fisheries contribution to GDP and adaptation readiness scores. Cuba and St Lucia, with high readiness scores have less than 1% of fishery contribution to their GDPs. Grenada, with the highest fishery contributions to its GDP (3.01%) also recorded high adaptation readiness scores. Grenada is the only country with high readiness score and high fishery contribution to GDP. Dominica, recorded high fishery contribution (2.58%) to its GDP but had a low adaptation readiness score. This disproportionate results indicate that the contribution of fisheries to GDP of island countries in the Caribbean does not have any significant influence on adaptation readiness. This is because countries most island countries do not have a lot fisheries as a major economic sector. Thus fisheries contributes little to their respective

developments. This result is related to the previously suggestions in the thesis that fisheries is not the most significant sectors in the island countries of the Caribbean.

Chapter 6: Discussion

6.1 Introduction

This Chapter outlines the relevant key messages and development lessons from the empirical results from Chapter 5. It provides detailed account of the government level analysis of readiness among countries in the Caribbean. The theoretical perspective of this research is its response to the climate change and development debates.

6.2 Major Development Issues and Lessons

Results and findings from this study presented several lessons in form of pragmatic development information about how governmental level readiness can successfully support adaptation to climate change in relation to fisheries, communities and fishing communities.

One of such key lessons is the significance of national strategy papers, national acts and legal frameworks as well as UNFCCC Communications. These indicators constitute political leadership component and it is one of the most consistent components with eight countries scoring high readiness and with only one country (Dominican Republic) recorded low readiness. These indicators are vital as they keep record on adaptation measures and processes. That is increasing climate change developments need strategies, policies and plans to accommodate new issues and linkages (Glynn & Taplin, 2013). This study indicates the relevance of strategies and plans. For example, the Bahamas National Climate Change Policy; the National Climate Change Strategy of Cuba; and the Jamaican Climate Change Policy adaptation plans and procedures have demonstrated the positive implications for national strategies and plans. All countries in the Caribbean also exhibited either first and/or second UNFCCC's communications which are necessary for climate

change assessment, hence the high and consistent scores. In the context of development studies, adaptation mainstreaming strategies and plans from Bahamas, Cuba, Barbados and Jamaica can be emulated by other small island developing countries around the world.

Another important message from the results and analysis of this study is the role of Ministries, Departments, Agencies and Units as well as Climate Change Working Groups. These institutions provide proficient and operative governing bodies that support adaptation planning and policy. For instance, the Government of Barbados' efforts in restructuring and reorganising of the Ministry of Energy and Environment, Meteorological Department, as well as the Department of Emergency Management in addition to the formation of the Central Emergency Response Organization (CERO) have manifested its high readiness score. Also, four countries - Cuba, Saint Lucia, Barbados and Haiti - with high readiness, presented concrete evidence on establishing and restructuring of local infrastructures, ministries, departments and units for adaptation initiatives as well as climate change mainstreaming initiatives. Although, Haiti one of the poorest countries in the Caribbean sub region, but it recorded high readiness for this component (institutional organisation) mainly because it demonstrated enough evidence of institutions that are necessary for adaptation planning. These institutional reorganisation and reconstruction is a good lesson for other small island developing countries.

Educational and awareness creation programs that prompt adaptation readiness and preparedness for climate change is necessary as it evaluates community representation (McNamara, 2013). This is very crucial for development since climate change directly and indirectly affects the socio-economic activities of people. Thus decision making in the

context of climate uncertainties is relevant since adaptation has human elements, factors and actions. This study shows that private sector, civil society and the general public were involved in climate change planning and development in the Caribbean. Such plans include climate change educational and awareness creation programs which reflect community needs and principles.

Educational awareness programs on climate change has been one of the consistent indicators for institutional organisation in the study with eight out of thirteen countries having high readiness. The high readiness is based on the documentation of a number of public awareness creation and engagement plans for climate change adaptation organised by international organisations such as UNEP, UNDP, and GEF. Individual countries also organised crucial awareness and educational programs with adequate participation of communities, fisheries and especially, fishing communities. A typical example is Cuba which has incorporated disaster management, hurricane preparedness and climate change adaptation in schools curriculum to equip students with requisite knowledge for future disasters. Likewise, community awareness programs were organised in Cuba to practice drills before each hurricane season. Research and information are vital to inform climate change adaptation actions and initiatives. It has been agreed by many scholars that there is a positive relationship between research and all aspects of development. The science of climate change is multidisciplinary, thus involving natural, social sciences and geomatics, therefore information sharing and data support is significant to adaptation planning. (Burroughs, 2007).

Findings from this research also confirms the importance of research and development in climate change adaptation readiness. Research institutions, national academies, research centres and universities are the main research institutions in the Caribbean that conduct empirical climate research. These institutions showed different information on vulnerability hotspots and hazard regions. The University of West Indies, CARIBSAVE, CCCCC, and C-Fish were identified as the main institutions for research. For instance, CARIBSAVE provided information on Climate Change Risk Profile and Climate Change Atlas for Jamaica, Bahamas, and Barbados. National academies and the University of West Indies also provided research on National Assessments such as NAPA and NAPs. Also, the findings and analysis show that Jamaica, St Vincent and the Grenadines, and Barbados are the homes of lead research institutions such as CARIBSAVE, The University of West Indies, Caribbean Maritime Institute (CMI), and Caribbean Regional Fisheries Mechanism.

Another significant pattern from this study is availability and accessibility of funds to finance adaptation readiness initiative. Funding is obligatory for adaptation to be operational and sustainable (Smith et al, 2011). Funding may come from different sources – government, private industry, foundations, and professional organisations, along with international organisations. The most important source of funding according to this research is funds from international organisations. The most popular is The Global Environment Facility (GEF). Over 10 billion US Dollars was invested in the region in 2010. However, there has not been any proof of how accessible these funds are to communities, fisheries and especially fishing communities. Government environmental planning budgets

do not have adequate information on fisheries and fishing communities. The overall result for this study shows that access to funding for adaptation readiness has been challenging in the region. This confirms conclusions of Shardal & Samuel (2008) and Parry (2009), that climate change funding access to developing countries have been on the low side. However, findings from the Dominican Republic which indicated how the government budgeted about USD\$1 million towards training teachers in communities in climate change adaptation. This could be emulated by other small island developing countries to improve their levels of adaptation.

Science and technological assessment has been emphasized in several areas of adaptation readiness, preparation and intervention. Different forms of technologies that necessary for coastal protection technologies comprises sea defence walls and early warning tools, but they are seen to be very expensive and can have destructive side effects (Klein et al, 2001). Currently, cheaper technological based interventions such as rain water harvesting, which involves the collection of water for different uses, has been seen as a cost effective technology for adaptation in communities around the world. The result suggests that Cuba, Bahamas and Grenada are the top three ranked countries for science and technology. They exhibited enough evidence on technologies such. For instance, The Government of Cuba established a world-class meteorological institute as well as weather and climate tracking systems in all 15 provinces of Cuba. These institutions have direct link with communities and other climate sensitive sectors of the economy which includes the fishery sector. Bahamas and Grenada on the other hand also shown several rainwater harvesting activities.

It is important to note that giving the constrictions and limitations of this research, some published literatures may have been overlooked. Some documents such as those found in grey literature may be meaningless and might not reflect the real situation about readiness of countries in relation to communities and fisheries. Scores only look at the presence of communities, fisheries and fishing communities in documentations and this does not say anything about the quality of adaptation efforts by countries because results are based on only what is available in the documents and not actual on-the-ground results. Therefore, one does not know the true readiness of countries. Also, the results may either be over-stating readiness or understating it and this depends on differences in documentation and reality. However, this is a good first step towards a more integrated and comprehensive future research.

6.4: Adaptation Readiness and Socio-Economic Indicators

Climate change has significant socio-economic impacts as well as exerts socio-economic pressures on small island developing countries. Creating the link between socio-economic indicators and climate change provide prospects to explore long-term balanced societal responses. Part of this study assesses the impact of Human Development Index (HDI), Gross Domestic Product (GDP) per capita, fishery as a percentage of GDP, and fishery production on government level adaptation readiness in relation to communities, fisheries and fishing communities. This result produced remarkable connections.

In terms of Human Development Indices (HDI), eleven countries with high HDI also had high and/or moderate adaptation readiness scores. Cuba, Bahamas, Barbados, and Antigua and Barbuda, the countries with the highest ranked HDIs, recorded high and

moderate readiness scores, while Saint Lucia, Jamaica, Dominican Republic and Haiti, the lowest ranked countries, obtained low and moderate readiness scores. Findings also shows an interesting trend between Cuba and Haiti. For instance, Cuba, the highest ranked HDI country (1st position among the countries studied), is also the country with the overall highest adaptation readiness score. Similarly, Haiti, the lowest ranked country in terms of HDIs, had the second overall lowest adaptation readiness score.

However, this research observed that two countries - Saint Lucia and Grenada - documented high readiness scores but did not demonstrate high rankings in their HDIs. Interestingly, Dominica, with a relatively good HDI value according to UNDP standards, had the lowest adaptation. In a developmental perspective, one can say that human development indices have no connections with governmental level climate change adaptation readiness in the Caribbean. That is indicators for HDIs do not necessarily have any impact on how ready a country can be for adaptation in relation to fisheries and fishing communities.

Gross Domestic Product (GDP) per capita and governmental level climate change adaptation readiness in the Caribbean also recorded similar trends as HDIs. Saint Lucia and Grenada, with GDP per capita of USD\$ 7, 200 and USD\$ 7, 418 respectively, had moderate adaptation readiness scores. According to the UN standards, GDP per capita, with values under USD\$ 10,000 are low, hence the scores and analysis indicated GDP per capita does not have adaptation readiness scores in this study. Moreover, Bahamas with GDP per capita of USD\$ 21,624 recorded a moderate adaptation readiness score with a country average readiness score of 53.2%. Haiti, with a poor GDP per capita - USD\$ 706 - also performed

poorly based on adaptation readiness scores. The three richest countries in the region - Bahamas, Trinidad and Tobago, and Barbados, based on their GDP per capita had moderate readiness scores. In all, these results show that rich countries in the island countries do not necessarily have adequate adaptation readiness, in relation to communities, fisheries and/or fishing communities.

The study further points out that countries -Bahamas, Trinidad and Tobago, and Barbados- may be rich, but funding for adaptation programs may not necessarily be available or accessible to communities. This trend with GDP per capita in the study confirms that a country may be poor (Cuba) but can be able to achieve its adaptation goals through adequate and efficient planning whereas rich countries could do better in terms of planning for all sectors of their economy including fisheries.

Fisheries and aquaculture activities provide support for socio-economic development in the areas of employment and income. In the Caribbean, fisheries contributions to the economies is minor compared to tourism and agriculture, but future assessments specify that the majority of the fisheries and fishing communities will be affected by climate change. Findings from the study shows that Cuba and St Lucia, with high readiness scores have less than 1% of fishery contribution to their GDPs. Grenada, with the highest fishery contributions to its GDP also recorded high adaptation readiness scores. Grenada is the only country with high readiness score and high fishery contribution to GDP. Dominica, recorded high fishery contribution to its GDP but had a low adaptation readiness score. This disproportionate results indicate that the contribution of fisheries to GDP of island countries in the Caribbean does not have any significant influence on adaptation readiness. However, lessons can be learnt by other countries in the global south

on how readiness is important for the fisheries sectors due to the anticipated negative influences of climate change impacts.

6.5 Influencing Factors

Based on examples from these selected countries, this research identified several features, structures and barriers that influence adaptation readiness and development in the Caribbean. These are grouped into 3 main categories or factors: economic, political and institutional.

Economic factors

Different economic factors determine how ready countries are to cope with extreme changes in weather and climate events. For countries in the Caribbean, key economic factors that affect their readiness to adapt to future and current expected changes are: funding, national budgets, GDP per capita, donor agencies, and fishery as a percentage of GDP.

Information gathered for this research revealed that UNFCCC's Adaptation and Green Funds were the main sources of funds for most island countries in the Caribbean. For instance, Jamaica and Cuba received USD \$9.96 million and USD \$6.01 million, respectively, from the Adaptation Funds to finance adaptation projects. Other sources of funds include the Climate Investment Fund in Dominica and Grenada, the Clean Technology Fund in St Kitts and Nevis, the Caribbean Catastrophe Risk Insurance Facility in St Lucia. However, information gathered for this study did not show evidence of the accessibility of these funds to fisheries and fishing communities.

Another important source of funding in the study is national or government budgets. Budgets include governments projected revenue and spending for the financial or fiscal year. The major national budgets identified in the study made general provisions for funds to address environmental problems but information gathered for this study did not acknowledge funds being devoted to communities, fisheries and/fishing communities. However, the Government of the Dominican Republic committed USD \$1M from the national budget for climate change training for teachers in 2014-2016 (Government of the Dominican Republic, 2013).

Other relevant economic factors are GDP per capita and donor agencies e.g. GEF and Green Fund, IDB. GDP per capita played a crucial role in adaptation readiness. Countries with high GDP per capita did not necessarily have high readiness. Cuba, the country with the overall highest adaptation readiness score, has a very low GDP per capita (USD \$6,301 in 2012). Similarly, Bahamas, the richest country in terms of GDP per capita, did not have a high adaptation readiness score.

Funds from donor agencies and foundations such as the World Bank, the Caribbean Development Bank, IDB, GEF, USAID, DFID, and Sur Futuro Foundation were also identified. However, according to my research, the information available did not exhibit enough material on these fund's availability to communities, fisheries, and specifically fishing communities. Additionally, no data was found for Green leasing, multilateral agreements and co-funding, which are popular adaptation funding initiatives.

Finally, information gathered for this research shows that fishery as a percentage of GDP and fisheries production per year in island countries of the Caribbean did not influence

climate change adaptation readiness scores. For example, Dominica, Antigua and Barbuda, and Bahamas had more than 1% of fisheries contribution to their GDP, but they did not record high adaptation readiness scores. Also, in 2007, Dominican Republic produced about 92,000 tonnes of fish (representing the highest production in the region) but this did not reflect in their adaptation readiness scores. Funding is a decisive and important indicator for adaptation in climate change adaptation.

Political factors

Government policies and administrative practices are essential for climate change adaptation readiness. These policies and practices include relevant institutions, legislations, regulations and frameworks that are obligatory for climate change adaptation. In this study the common political factors identified are UNFCCC's communications, political institutions, adaptation strategies and plans. The other forms of political factors are climate change mainstreaming initiatives, inter-agency and cross sectorial partnerships and climate change committees.

The UNFCCC's Communications for Climate Change Adaptation is an important tool for adaptation preparedness. With both financial and technical assistance provided through the UNFCCC, country communications are important mainly because they provide reliable national reports. This study discovered that all thirteen island countries in the Caribbean have their Initial National Communication for Climate Change. However, only six countries - Bahamas, Dominica, Dominican Republic, Jamaica, Saint Lucia, and Trinidad and Tobago – also have their Second National Communication on climate change.

This shows a significant gap when compared with countries with Third and even Fourth UNFCCC communications.

Furthermore, institutions, such as ministries and departments set up by governments, provide support for climate change policies, strategies and plans. The study acknowledges several institutions in the form of ministries in the Caribbean region that deal with climate change in communities, fisheries and specifically fishing communities. For instance, Jamaica has the Ministry of Water, Land, Environment and Climate Change focusing on climate change initiatives. Further, the Ministry of Agriculture, Forestry and Fisheries in Saint Lucia, the Ministry of Agriculture, Fisheries and Local Government in Bahamas, the Ministry of Fishing Industry in Cuba, and the Ministry of Environment and Water Resources in Trinidad and Tobago all have strategies and plans for communities and fisheries. Among these ministries, Jamaica and Cuba demonstrated clear evidence on climate change and fisheries.

In addition, departments, agencies and units responsible for climate change and fisheries activities were also seen in this study. St Kitts and Nevis has a Department of Physical Planning, National Resources and the Environment; there is a Climate Change Unit in Dominican Republic; as well as a Coastal Zone Management Unit in Barbados; Department of Civil Protection in Haiti, and National Disaster Management Agency in Grenada. These departments, units and agencies serve as an official institution for organising, implementing and evaluation adaptation planning activities as well as helping govern regulations within communities which are exposed to the dangers of climate change.

The next set of political factors recognised in this study are National Climate Change Adaptation Policies and Plans. The policies and plans serve as guidelines for countries to cope with and adapt to climate change. For instance, the Bahamas National Climate Change Policy, the Dominica Climate Change Adaptation Policy and Action, the Jamaica National Strategy and Action Plan, the National Climate Change Policy and Adaptation Plan in Saint Lucia, the National Adaptation Strategy in Barbados are examples of policies and plans that represent country specific programs for adaptation preparedness. Other forms of plans and strategies identified are Strategic Program for Climate Resilience in Grenada and Haiti. However, most of these policies were very broad and did not demonstrate specific programs that deal directly with communities, fisheries and fishing communities which is of great importance for my study. It is also important to mention that island countries in the Caribbean need an overhaul of strategies and plans to include community involvement, fisheries, and fishing communities, not just institutions and policies.

Institutional factors

Various social factors have been cited in the study as contributing to climate change adaptation readiness in relation to communities, fisheries and/or fishing communities in the Caribbean. These factors have direct influence on communities especially those that are engaged in fishing activities. They include research facilities and academic institutions, stakeholder involvement, educational and awareness creation through town hall meetings. However, no one factor has been shown to be sufficient for adaptation readiness efficacy.

Thus, this research suggests the need for an integrated approach in all social factors due to the complex and dynamic nature of climate change adaptation.

Several research institutions and academic facilities for adaptation readiness were identified. The most famous institutions which conduct adequate adaptation research were mainly external institutions. CARIBSAVE, a Caribbean regional not-for-profit organisation, was identified as an organisation with research and studies that combine climate change adaptation, fisheries and fishing communities. Some of their projects are Climate Change Risk Profile and Climate Change Atlas for Jamaica, Grenada, Trinidad and Tobago, and Antigua and Barbuda. The Caribbean Community Climate Change Centre (CCCCC), also has climate change adaptation plans and projects that involve communities and sometimes fishing communities. A similar trend was seen in Caribbean Agricultural Research and Development Institute (CARDI), The Caribbean Natural Resources Institute (CANARI) and The Caribbean Regional Fisheries Mechanism (CRFM).

Internal research institutions that conduct adaptation research in individual countries in the Caribbean are also recognized. The Fisheries and Aquaculture Research Programme in Trinidad and Tobago, Technological Institute of Santo Domingo in Dominican Republic, Cuban Academy of Sciences, Cuban Research Institute, Centre for Environmental Resource and Management Studies in Barbados, Marine and Environmental Studies Institute in Bahamas, Office of Disaster Preparedness and Emergency Management in Jamaica, The University of West Indies in Jamaica, Trinidad and Tobago, Barbados among other institutions. Interestingly, lack of research in climate adaptation readiness was one of the main issues that was common in this study. Thus, while most of these research

organisations and institutions are common in the region, there is not enough evidence of research conducted for fisheries and specifically fishing communities.

Another essential social factor important to this study is community involvement, participation and consultations. This is important because involvement and participation provides the opportunity for people in communities to have a chance to speak their mind and creates the respect for individuals and their points of view. In this research some countries provided these opportunities for individual participation. For instance, The Ministry of Water, Land, Environment and Climate Change in Jamaica carried out a series of public consultations on its Green Paper and requested comments on the proposals. This document was made available at libraries and Parish Councils and also on the Ministry's website. Non-Governmental Agencies also played relevant roles in most of the island countries studied. Saint Vincent and the Grenadines formed 40 local community disaster committees for adaptation readiness and to educate communities to build capacity for climate change adaptation. National Consultative Workshops on adaptation preparedness were organised in Dominica, and Bahamas has a National Coastal Awareness Committee with the aim of deepening awareness and encourage participation

Indeed, climate change is already affecting the world's poorest and most vulnerable communities. Efforts to incorporate adaptation into the development planning process must guarantee that the most susceptible groups (fisheries and fishing communities) in developing countries are central to the rapidly expanding climate change research and policy agenda mainly because these groups of people often lack the robust structures and capacities needed to cope. I have provided enough evidence, data and analysis to answer my questions posed in the introduction

In the Caribbean, climate change adaptation readiness by governments in relation to communities, fisheries and especially, fishing communities' show different levels of readiness. Thus readiness differs or varies from one country to another depending on several factors outlined in the above discussion. The above discussions also demonstrated how some governments are more advanced in terms of their levels of readiness (funding, institutions, leaderships, research, science and technology etc. than others. The above discussions also established how socio-economic states of countries in the Caribbean do not necessarily affects their levels of adaptation in relation to communities, fisheries and fishing communities.

Vulnerability of countries

The levels of vulnerability to climate change impacts do not have any significant influence on readiness levels of countries. While Haiti, Dominican Republic, and Saint Vincent and the Grenadines are considered as the most vulnerable to climate change impacts, results from this research show that they are the least ready country. The same trend was shown by least vulnerable countries like Bahamas, Barbados and Antigua and Barbuda did not exhibit high readiness. This shows that the regions vulnerability do not reflect in their levels of readiness in relation to communities, fisheries and fishing communities.

6.6 Synthesis

In terms of addressing the central question namely, how and to what extent are the governments of the Caribbean islands ready to adapt to the impacts of climate in relation to communities, fisheries and especially, fishing communities? In response to climate

change impacts and effects, national governments have developed policies and economic management systems in the form of institutional reconstructing, funding allocation, science and technology as well as research in order to manage extreme events and to be resilient. For example, The Office of Disaster Preparedness and Emergency Management (ODPEM) in Jamaica and the National Emergency Management Agency (NEMA) in Trinidad and Tobago have been instituted for the purpose of adaptation readiness. Climate change mainstreaming initiatives in Saint Lucia also shows their readiness level. A National Adaptive Capacity framework was established in most Caribbean countries to assess the performance of national institutions that are responsible for adaptation.

In terms of addressing the second question which is interrelated to the central that is, how governmental level adaptation readiness differ between selected island countries in the Caribbean in dealing with communities, fisheries and/or fishing communities? Countries are affected by climate change in different forms due to their location, resilient levels and adaptive capacities and therefore their readiness to adapt varies. In the Caribbean, countries are committed to building institutions and organisations for adaptation, others are keen on science and research initiatives as well as mainstreaming adaptation into national development planning. For example, Technology Based Interventions and Assessment Reports are on the agenda of the Government of Trinidad and Tobago while Grenada developed effective education and public awareness programs.

In addressing the third related question namely, why are some island countries in the Caribbean region more advanced on adaptation readiness than others in terms of communities, fisheries and fishing communities? This is mainly because some countries

allocate more funds to their adaptation initiatives than others. Findings indicate that, countries which commit enough funds to their adaptation initiatives turn to be more advanced than countries with less funding. Also, scientific and technological modifications among countries have resulted different ways to adapt. For example, In Bahamas, the provision of Local Radar as well as a linking with international radar for tracking storms in communities is an important factor for its adaptation advancement.

In support of my argument that funding is the main driver of whether or not a country has high or low adaptation readiness is the discussion below:

Climate change adaptation is about building resilience and decreasing vulnerability. Knowing the vulnerability challenges in the Caribbean island countries, funding is important to drive the performance of other adaptation mechanisms, to finance concrete adaptation projects and programmes, and for scientific research and development. Climate funds, both fiscal transfers and market transactions, from developed to countries in the global south represent the primary way to merge equity with effectiveness and efficiency in dealing with the climate problem (World Development Report, 2010). Different financial flows can help countries reduce their greenhouse gas emissions, adapt to the effects of climate change, and carry out activities for weather and climate related emergencies and disasters.

Funding for adaptation can be in the form of monetary resources by national, regional and international bodies for climate change adaptation projects and programs. Funding agencies and institutions are national budgets, bilateral and multilateral agreements, private sector contributions, and foundations. Others are from international

organisations which assign funding resources through the Adaptation Fund under Kyoto Protocol, and the Global Environment Facility (GEF) Special Climate Change Fund. This creates the opportunities and prospects for small island developing countries to be resilient and develop robust adaptation plans. Additionally, the GEF Strategic Priority on Adaptation has been useful for pilot projects focusing on the ground assessments. Other potential sources include carbon financing, and green investments through payment for ecosystem services (Hanley & White, 2014).

Drawing upon the adaptation readiness framework by Ford and King, (2013), six components were identified as the most crucial. Assessing these components demonstrate that some countries are far readier than others because of funding. Funding is indeed the main driver of low or high adaptation readiness because it is central for all the other five key components identified in this study. Funding is compared in this research as a component in readiness according to the analytical framework used and this research this not look at aspects of funds at the community level.

Political leadership for adaptation is necessary to create adaptation awareness because climate change cuts across powers and jurisdictions. This is critical for initiating the process of adaptation as well as providing planned and realistic directions. Attributes that support leadership are National Climate Change Strategies, UNFCCC Communications, National Acts and Legal Frameworks among others as discussed in the methodology. These attributes can be effective when there are sufficient and adequate funds to support their execution and implementation. However other contributing factors are considered equally important as funds. For instance, sufficient funds are required to finance

adaptation policies and strategies as well as to mainstream climate change into national development policy frameworks but this cannot be done without proper institutional and political structures. In this study, Cuba, Grenada, Saint Lucia, and Saint Vincent and the Grenadines recorded high scores for political leadership because they demonstrated funds for political leadership. Grenada demonstrated enough evidence of funds in the development of its National Environmental Strategy as well as Action Plan on Adaptation to Climate Change, hence a high score. Dominican Republic, however, recorded low readiness because it did not of insufficient funds.

In addition, the present emerging concerns of climate change adaptation impacts and effects is an important development issue that require institutional overhaul, cross sectorial partnerships and ministerial reforms in order to create new organisations and linkages. (Literature on methodology). National and local governments have played crucial roles to build effective institutions for adaptation. This institutions are expected to provide proficient and operative governing bodies that support adaptation planning, policy and to provide technical support for vulnerable communities. Elements necessary for institutional organisations are climate change committees, community working groups, adaptation task forces among others. However, these elements requires adequate financial resources to be successful. That is funding is an important prerequisite for institutions to be efficient. In the Caribbean, four countries, Barbados, Haiti, Cuba and Saint Lucia registered high scores in providing institutional structures for adaptation this is mainly because of availability of funds. For instance, IDB grant for Sustainable Energy Framework for Barbados helped in

the creation of new local committees for climate awareness. Low readiness countries did not exhibit the use of such funds.

Research and information is vital to inform climate change adaptation action, and results from different climate research have implications for policy and project enactments. Research and information is considered as highly capital intensive or funding dependent. That is climate change information and research involves acceptable funds for vulnerability assessment, impact assessment, and funding of research initiatives as well as research activities. Four countries- Jamaica, St Kitts and Nevis, St Lucia, and Barbados - scored high levels of readiness for this component because they devoted a lot of funds to research and information initiatives. For example, CARIBSAVE activities provided Climate Change Risk Profile and Climate Change Atlas for Jamaica. This research group is supported by funds from both local and international sources. However, low readiness levels were recorded for Research and Information for other countries because there has not been any evidence of funds allocated to lead research activities. For example, Dominica, and Antigua and Barbuda do not have universities or environmental research institutions necessary for climate research due to the large funding involved in creating one.

In addition, science and technology assessment has been highlighted in several areas of adaptation preparation and intervention. However, large amounts of capital in the form of funding and other financial commitments are needed to adequately invest in science and technology programs. The most common forms of science and technology established in this research are rain water harvesting, aquaculture and irrigation projects. These projects cannot be effective unless there is adequate capital to support it. For instance, a significant

amount of funding is required for complex or sophisticated forms of science and technology such as geo engineering, ozone layer repair. These scientific and technological activities demand large capitals. In this study, countries (Bahamas and Cuba) with large financial commitments towards science and technology initiatives, like the “Civil Defence System” in Cuba recorded high readiness levels while Haiti and Antigua and Barbuda, recorded low because of inadequate financial resources to support science and technology programs.

Stakeholders in the private sector, civil society, as well as the general public are very influential in adaptation planning. Several public private partnerships have led to different adaptation programs and initiatives such as community awareness creation, mangrove restoration programs, afforestation. These public engagement activates and initiatives are dependent on availability and accessibility of funds. In this study, countries which show high readiness provided evidence of funding to organise programs that involve local communities in adaptation initiatives. For instance, the Bahamas National Coastal Awareness Committee has been provided adequate funds through national budgetary allocations, hence the high readiness score. Dominica scored low in this component because the Pilot Program for Climate Resilience has not seen enough funding for it to be sustained. Funding is therefore the most important factor because it serves as a baseline for all the other components. Again a combination of other factors rather than funding is relevant for this component to operate at its fullest capacity.

Funding is considered as the baseline component. All other components are highly dependent on it. Political Leadership, Institutional Organisation, and Adaptation Decision Making and Stakeholder Involvement demonstrated enough evidence on government level

readiness in relation to communities, fisheries and fishing communities and recorded the most consistent scores but these components were driven by the amount of funding committed to them. Ultimately, Funding binds all other adaptation readiness components. However, while funding may be imperative for some indicators within a single component, it may not be the most important to all components.

It is essential to note that different countries are represented in at the bottom of each component. For instance, Barbados, Haiti and Dominican Republic are represented at the bottom of the Political Leadership while Bahamas, Saint Kitts and Nevis, Dominica are at the bottom of Adaptation Decision Making. This indicates that the readiness levels of countries differ from component to component. One country may be high in direct its resources on research at the expense of another component such as political leadership.

Chapter 7: Conclusion and Recommendations

7.1 Conclusion

Climate change has become a dynamic issue in the field of development because it has the prospect to change the way countries deal with their resources, priorities and development needs. Each country will experience the impacts and effects of climate change differently and island countries in the Caribbean will be influenced differently. Therefore, balancing climate change and development efforts through adaptation policy planning at the governmental level is vital. Recognising the high level of vulnerability of the Caribbean region to climate change, readiness evaluation is imperative for effective planning and for sustainable development.

As previously discussed, this research evaluates government level climate change adaptation readiness for the Caribbean with special focus on attention to communities, the fisheries sector, and specifically to fishing communities. This evaluation is based primarily upon the Ford and King (2013) adaptation readiness framework. This study advances this further by critically examining readiness levels of island countries in the Caribbean in relation to communities, fisheries and especially fishing communities.

In addition, this research concentrates on evaluating the inclusion of communities, fisheries and fishing communities in the Caribbean climate change adaptation plans, policies and projects. The central research question is to determine the extent at which governments in the Caribbean are ready to adapt to the impacts of climate in relation to communities, fisheries and especially, fishing communities and related to the central research question are further dimensions of research, such as: the importance of adaptation

government level readiness to island countries in the Caribbean in relation to communities, fisheries and specifically, fishing communities; how adaptation readiness differs between selected island countries in the Caribbean in dealing with communities, fisheries and/or fishing communities; and why some island countries in the Caribbean region more advanced on adaptation readiness than others in terms of communities, fisheries and fishing communities.

This thesis outlined the various institutional arrangements and processes that are necessary for countries in their adaptation processes. These include, as evident with various countries, the UNFCCC Initial and Second communications, national adaptation policies, restructuring and reorganising institutions as well many steps relevant for countries to access vulnerability and adaptation to climate change.

National organizations and knowledge networks play essential parts in climate change policy and planning. The creation of a National Climate Change Committee in almost all countries in the Caribbean as well as the restructuring of various policy frameworks have provided opportunities for partnerships and the synchronization of rules and regulations for adaptation. This assessment further emphasises the importance of local programs and international partnerships to address climate and development challenges. Unlike most developed countries that are self-reliant in climate change plans and policies, the Caribbean region lacks the necessary resources to cope with rapid environmental changes, such as climate change.

This research also compares readiness scores of countries to their GDP per capita, contribution of fisheries to GDP, and Human Development Index. This integrated appraisal

and evaluation of climate change adaptation readiness in Caribbean communities, fisheries and fishing communities provides support for prioritizing programs, projects and plans for sustainable development. In addition, comparing results with relevant socio-economic indicators is useful to understand the practicability and consequences for the general socio-economic development of the Caribbean.

This thesis explored numerous different viewpoints and analysis of government level readiness in the Caribbean in relation to communities, fisheries and fishing communities. Initially, a review of literatures found that studying the linkages between climate change adaptations, communities, fisheries and fishing communities is essential and that these linkages can determine the level of adaptation and vulnerability approaches as well as sustain development. This research specifically explored how adaptation readiness differs from one government to another, in terms of attention to fisheries and communities. While some countries are ready through reconstituting and restructuring their institutions in addition to national policies for adaptation. Technology also varies from one country to another. The research has explored different technological methods and measures by countries to adapt to the impacts and effects of climate change. Again, different approaches have been adopted in the Caribbean to fund governmental level adaptation initiatives. The most popular according to this research is funds from external sources especially GEF. Other countries augment these external funds from internally generated funds as well as budgetary allocations to fund adaptation projects and plans.

It is vital to outline and summarise the limitations and shortcomings of this thesis which consist of only governmental-level analysis and assessment of adaptation readiness

and does not involve community-based fieldwork; it is only about climate change adaptation readiness in relation to communities, fisheries and especially, fishing communities and that readiness in relation to other sectors such as mining, farming, tourism, forestry could be different; related secondary data was sometimes not available or accessing available usable data was difficult/impossible. One does not know if information could be available in hard copy since the researcher only depended on online data and information. Data collection and sorting was also usually time consuming; language barrier was another constraint some countries' data were in Spanish (Cuba and Dominican Republic) and French (Haiti).

Results and discussions may be quite different if countries were focusing on tourism. This is because in the Caribbean countries have had a good history of tourism development, and the region as a whole has seen much growth in the tourism sector than other sectors. For instance, the tourism industry in the Caribbean earns foreign exchange, provides jobs for citizens, and revenue to governments. This sector is relative more vital than the fishery sector.

Further, due to the constrictions and limitations of this research, some published literatures may be have been overlooked. Some documents such as those found in grey literature may be meaningless and might not reflect the real situation about readiness of countries in relation to communities and fisheries. Scores only look at the presence of communities, fisheries and fishing communities in documentations and this does not say anything about the quality of adaptation efforts by countries because results are based on only what is available in the documents and not actual on-the-ground results. Therefore,

one does not know the true readiness of countries. Also, the results may either be overstating readiness or understating it and this depends on differences in documentation and reality. However, this is a good first step towards a more integrated and comprehensive future research.

7.2 Recommendations for Further Research

Climate change practically affects all physical and human systems directly and indirectly. Research concerning adaptation in communities, fisheries and fishing communities is important in providing relevant information to policymakers, decision-maker and other relevant stakeholders. Engaging different groups of people (communities, donor agencies international organisations) in climate change policies and programs is important. This is because policies and programs have sociological indicators therefore failure to engage or involve them will either delay or make programs ineffective. The result of this thesis can be put to the test through on-the-ground future research and applications to specific fisheries and/or specific communities. The results could also augment future research to assess the real readiness of communities and countries that are impacted and affected by climate change.

Also, it is important to note that my preliminary research could be applied in other socio-economic sectors which are affected by climate change. Whereas, the tourism sector has been extensively researched in the Caribbean, this research identified two important areas that could apply the method I used in this thesis. They are: the agricultural sector, including farming communities, and the forestry sector, comprised of forest communities and communities that are dependent on forest resources. These areas should be researched

for evaluation, assessment and participation in climate change policy. The specific areas to be researched are:

- ✓ Agricultural/farming communities especially plantation agriculture which is popular in the Caribbean, to assess and ascertain the severe impact of climate change as well as evaluate agricultural/farming communities' participation in climate change adaptation activities.
- ✓ Forestry communities must also be investigated to evaluate their level of participation and involvement as well as readiness in climate change adaptation policies, projects and programs.

References

- Adaptation Fund, (2014) Readiness Programme for Climate Finance - an Adaptation Fund initiative <https://adaptation-fund.org/node/3944>
- Adger, W. N., Huq, S., Brown, K., Conway, D., & Hulme, M. (2003). Adaptation to climate change in the developing world. *Progress in development studies*, 3(3), 179-195.
- Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global environmental change*, 15(2), 77-86.
- Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R. & Wreford, A. (2009). Are there social limits to adaptation to climate change? *Climatic change*, 93(3-4), 335-354.
- Adger, W. N. (2010). Social capital, collective action, and adaptation to climate change. In *Der klimawandel* (pp. 327-345). VS Verlag für Sozialwissenschaften
- Agrawal, A. (2010). Local institutions and adaptation to climate change. *Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World*. Washington DC, World Bank, 173-198.
- Aldy, J. E., Krupnick, A. J., Newell, R. G., Parry, I. W., & Pizer, W. A. (2009). *Designing climate mitigation policy* (No. w15022). National Bureau of Economic Research.
- Allison, E. H., & Ellis, F. (2001). The livelihoods approach and management of small-scale fisheries. *Marine policy*, 25(5), 377-388
- Allison, E. H., Perry, A. L., Badjeck, M. C., Neil Adger, W., Brown, K., Conway, D. & Dulvy, N. K. (2009). Vulnerability of national economies to the impacts of climate change on fisheries. *Fish and fisheries*, 10(2), 173-196.
- Allison, E. A., Horemans, B., & Béné, C. (2006). Vulnerability reduction and social inclusion: strategies for reducing poverty among small-scale fisher folk. In *Wetlands, Water and Livelihoods Workshops*.
- Antigua and Barbuda Budget Statement 2013. Found at: http://www.ab.gov.ag/gov_v3/pdf/treasury/budget_speech_2013.pdf 25th December, 2014

- Ayers, J. M., Huq, S., Faisal, A. M., & Hussain, S. T. (2014). Mainstreaming climate change adaptation into development: a case study of Bangladesh. *Wiley Interdisciplinary Reviews: Climate Change*, 5(1), 37-51.
- Bals, C., Warner, K., & Butzengeiger, S. (2006). Insuring the uninsurable: design options for a climate change funding mechanism. *Climate Policy*, 6(6), 637-647.
- Bao, J. Q., Miao, Y., & Chen, F. (2008). Low Carbon Economy: Revolution in the Way of Human Economic Development [J]. *China Industrial Economics*, 4, 017.
- Banuri, T. (2009). Climate change and sustainable development. In *Natural Resources Forum* (Vol. 33, No. 4, pp. 257-258). Blackwell Publishing Ltd.
- Bark, R. (2009). *Assessment of climate change impacts on local economies*. Working Paper. Cambridge, MA: Lincoln Institute of Land Policy.
www.lincolninst.edu/pubs.
- Bell, WP & Froome, C (2012). Reviewing the Climate Change Adaptation readiness of the Australian National Electricity Market Institutions, Energy Economics and Management Group, *The University of Queensland, Brisbane*.
- Belle, N., & Bramwell, B. (2005). Climate change and small island tourism: Policy maker and industry perspectives in Barbados. *Journal of travel research*, 44(1), 32-41.
- Benjamin L (2011). Activities of the Public Education and Outreach Subcommittee 2010-2011 and summary of Climate Change Research at The College of The Bahamas
http://www.cob.edu.bs/conferences/CLIMATECHANGE_110922_LISABENJAMIN.pdf
- BEST Commission. (2001). Bahamas Environmental Handbook. The Government of the Bahamas (Bahamas Environment, Science and Technology Commission), Nassau, Bahamas.
- BEST Commission. (2001). First National Communication on Climate Change. The Government of the Bahamas (Bahamas Environment, Science and Technology Commission), Nassau, Bahamas.
- BEST Commission. (2005) Bahamas National Climate Change Policy the Government of the Bahamas (Bahamas Environment, Science and Technology Commission), Nassau, Bahamas.
- BEST Commission & SENES (2005) Final Report: The National Capacity Needs Self-Assessment (NCSA) Report (Bahamas Environment, Science and Technology Commission), Nassau, Bahamas.

- Bouwer, L. M., & Aerts, J. C. (2006). Financing climate change adaptation. *Disasters*, 30(1), 49-63.
- Brody, S. D., Zahran, S., Grover, H., & Vedlitz, A. (2008). A spatial analysis of local climate change policy in the United States: Risk, stress, and opportunity. *Landscape and urban planning*, 87(1), 33-41.
- Bueno, R., Herzfeld, C., Stanton, E. A., & Ackerman, F. (2008). The Caribbean and climate change: the costs of inaction. *Stockholm Environment Institute, US Center and Global Development and Environment Institute, Tufts University*.
- Caribbean Community Climate Change Centre, (2014). Information by Country http://caribbeanclimate.bz/index.php?Itemid=88&option=com_wrapper&view=wrapper
- Caribbean Community Climate Change Centre, (2009). National Adaptation Strategy to Address Climate Change Tourism Sector in Barbados, Synthesis of the Technical Reports: *Caribbean Community Climate Change Centre, Belmopan, Belize*
- Caribbean Planning for Adaptation to Climate Change (CPACC) 2001. Guide to the preparation of country policy papers on Climate Change adaptation, planning and management. Caribbean Planning for Adaptation to Climate Change (CPACC) *Regional Project Implementation Unit*, Barbados.
- Caribbean Planning for Adaptation to Climate Change & James P, (2002) Policy Framework for Integrated (Adaptation) Planning and Management in Antigua and Barbuda
- Challenger, B (2002). Identification of Climate Technology Needs for Antigua and Barbuda. Prepared as a *UNDP/GEF Project*
- Charles, A. T. (2008). *Sustainable fishery systems* (Vol. 5). John Wiley & Sons.
- Charles, A. (2012). People, oceans and scale: governance, livelihoods and climate change adaptation in marine social–ecological systems. *Current Opinion in Environmental Sustainability*, 4(3), 351-357.
- Change, C. (2007). Synthesis Report: Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Core Writing Team.
- Church, J.A., P.U. Clark, A. Cazenave, J.M. Gregory, S. Jevrejeva, A. Levermann, M.A. Merrifield, G.A. Milne, R.S. Nerem, P.D. Nunn, A.J. Payne, W.T. Pfeffer, D. Stammer and A.S. Unnikrishnan, 2013: Sea Level Change. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth

- Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. *Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA*
- Clay, P. M., & Olson, J. (2008). Defining "Fishing Communities": Vulnerability and the Magnuson-Stevens Fishery Conservation and Management Act. *Human Ecology Review*, 15(2), 143
- Cochrane, K., De Young, C., Soto, D., & Bahri, T. (2009). Climate change implications for fisheries and aquaculture. *FAO Fisheries and aquaculture technical paper*, 530, 212.
- Cordero, E., Todd, A. M., & Abellerra, D. (2008). Climate Change Education and the Ecological Footprint. *Bulletin of American Meteorological Society*, 865-872.
- Cole, D. H. (2008). Climate Change, Adaptation, and Development. *UCLA J. Env't. L. & Pol'y*, 26, 1.
- Collymore, J. (2011). Disaster management in the Caribbean: Perspectives on institutional capacity reform and development. *Environmental Hazards*, 10(1), 6-22.
- Cummins, A. (2004). The Marine Stewardship Council: A multi-stakeholder approach to sustainable fishing. *Corporate Social Responsibility and Environmental Management*, 11(2), 85-94.
- Dale, V. H. (1997). The relationship between land-use change and climate change. *Ecological applications*, 7(3), 753-769.
- Daw, T., Adger, W. N., Brown, K., & Badjeck, M. C. (2009). Climate change and capture fisheries: potential impacts, adaptation and mitigation. *Climate change implications for fisheries and aquaculture*, 107.
- De Brucker, K., Macharis, C., & Verbeke, A. (2013). Multi-criteria analysis and the resolution of sustainable development dilemmas: A stakeholder management approach. *European Journal of Operational Research*, 224(1), 122-131.
- Dessai, S., & Hulme, M. (2004). Does climate adaptation policy need probabilities? *Climate policy*, 4(2), 107-128.

- Ding, Y. D. J. G., Griggs, D. J., Noguer, M., van der Linden, P. J., Dai, X., Maskell, K., & Johnson, C. A. (2001). *Climate change 2001: the scientific basis* (Vol. 881). Cambridge: Cambridge university press.
- Ehrhardt, N. M., & Shepherd, D. (2001). 10. Guyana, Groundfish Fisheries. In Regional Reviews and National Management Reports: The Fourth Workshop on the Assessment and Management of Shrimp and Groundfish Fisheries on the Brazil-Guianas Shelf, Cumaná, Venezuela, 2-13 October 2000 (No. 651, p. 85). *Food & Agriculture Org.*
- Ellison, A. M., & Farnsworth, E. J. (1996). Anthropogenic disturbance of Caribbean mangrove ecosystems: past impacts, present trends, and future predictions. *Biotropica*, 549-565.
- Engloner, A. I. (2012). Alternative ways to use and evaluate Kohler's ordinal scale to assess aquatic macrophyte abundance. *Ecological Indicators*, 20, 238-243.
- European Commission, (2015) Adaptation to Climate Change. Retrieved from http://ec.europa.eu/clima/policies/adaptation/index_en.htm 14th December, 2014
- Fabry, V. J., Seibel, B. A., Feely, R. A., & Orr, J. C. (2008). Impacts of ocean acidification on marine fauna and ecosystem processes. *ICES Journal of Marine Science: Journal du Conseil*, 65(3), 414-432.
- FAO. (2012a). the State of Food and Agriculture 2012. Paying farmers for environmental services. Rome
- Feldman, I. R., & Kahan, J. H. (2007). Preparing for the day after tomorrow: frameworks for climate change adaptation. *Sustainable Dev. L. & Pol'y*, 8, 61.
- Few, R., Brown, K., & Tompkins, E. L. (2007). Public participation and climate change adaptation: avoiding the illusion of inclusion. *Climate policy*, 7(1), 46-59.
- Ford, J. D., Berrang-Ford, L., Lesnikowski, A., Barrera, M., & Heymann, S. J. (2013). How to track adaptation to climate change: a typology of approaches for national-level application. *Ecology and Society*, 18(3), 40.
- Ford, J. D., & King, D. (2013). A framework for examining adaptation readiness. *Mitigation and Adaptation Strategies for Global Change*, 1-22.
- Gallic, B. L., & Cox, A. (2006). An economic analysis of illegal, unreported and unregulated (IUU) fishing: Key drivers and possible solutions. *Marine Policy*, 30(6), 689-695.

- Giddens, A. (2009). The politics of climate change. *Cambridge, UK*.
- Gill, G. J., Farrington, J., Anderson, E., Luttrell, C., Conway, T., Saxena, N. C., & Slater, R. (2003). Food security and the Millennium Development Goal on hunger in Asia. *Overseas Development Institute (ODI)*.
- Global Environment Facility (2014) Bahamas and GEF Retrieved on 26th November
From:
<http://www.thegef.org/gef/sites/thegef.org/files/publication/Bahamas%20Country%20Fact%20Sheet%20English.pdf>
- Global Environment Facility, (2014) Country Fact Sheets Retrieved 22 October, 2014
from http://www.thegef.org/gef/country_fact_sheets
- Glynn, P. J., & Taplin, R. (2013). The essential role of employment and the workplace in climate change policy and effective disaster risk management planning. In *Climate change and disaster risk management* (pp. 399-409). Springer Berlin Heidelberg.
- Government of Antigua and Barbuda (2001) Biodiversity Strategy and Action Plan for Antigua and Barbuda.
- Government of Antigua and Barbuda (2009) Office of the Prime Minister, Retrieved: 20th October 2013
http://www.ab.gov.ag/article_details.php?id=307&category=66
- Government of Antigua and Barbuda (2010) Environment Management Strategy and Action Plan 2004-2009. Retrieved: 26th October, 2014
<http://www.pnuma.org/publicaciones/FINAL%20NES%20Antigua%20Barbuda%20Nov>
- Government of Antigua and Barbuda, (2014). Antigua and Barbuda Environment Division <http://www.environmentdivision.info/>
- Government of Antigua and Barbuda (2014). <http://www.ab.gov.ag/>
- Government of the Bahamas, (2013). National Policy for the Adaptation to Climate Change
<http://www.best.bs/Documents/ClimateChangePolicy.pdf> retrieved on 12th November, 2014
- Government of Barbados, (2001). Barbados' First National Communications under the United Nations Framework Convention on Climate Change (UNFCCC), *Ministry of Physical Development Environment*

- Government of Barbados, (2014). Barbados Integrated Government
<http://www.gov.bb/bigportal/big/index.php?cat=min&np=2>
- Grafton, R. Q., Arnason, R., Bjørndal, T., Campbell, D., Campbell, H. F., Clark, C. W. & Weninger, Q. (2006). Incentive-based approaches to sustainable fisheries. *Canadian Journal of Fisheries and Aquatic Sciences*, 63(3), 699-710.
- Graham J. Charles A. & Bull (2006). Community Fisheries Management Handbook
Gorsebrook Research Institute, Saint Mary's University (133) ISBN 0-9694095-6-7
- Green, A. O., & Hunton-Clarke, L. (2003). A typology of stakeholder participation for company environmental decision-making. *Business strategy and the environment*, 12(5), 292-299.
- Guillotreau, P., Campling, L., & Robinson, J. (2012). Vulnerability of small island fishery economies to climate and institutional changes. *Current Opinion in Environmental Sustainability*, 4(3), 287-291.
- Hardee, K., & Mutunga, C. (2010). Strengthening the link between climate change adaptation and national development plans: lessons from the case of population in National Adaptation Programmes of Action (NAPAs). *Mitigation and Adaptation Strategies for Global Change*, 15(2), 113-126.
- Harremoes, P., Gee, D., MacGarvin, M., Stirling, A., Keys, J., Wynne, B., & Vaz, S. G. (Eds.). (2013). *the precautionary principle in the 20th century: Late lessons from early warnings*. Routledge.
- Hart, M. (2011). Geographic Information Systems and System Dynamics-Modelling the Impacts of Storm Damage on Coastal Communities.
- Heck, S., Béné, C., & Reyes-Gaskin, R. (2007). Investing in African fisheries: building links to the Millennium Development Goals. *Fish and Fisheries*, 8(3), 211-226.
- Hilborn, R. (2007). Defining success in fisheries and conflicts in objectives. *Marine Policy*, 31(2), 153-158.
- Hobson, K., & Niemeyer, S. (2011). Public responses to climate change: The role of deliberation in building capacity for adaptive action. *Global environmental change*, 21(3), 957-971.

- Hoffmann, A. A., & Sgrò, C. M. (2011). Climate change and evolutionary adaptation. *Nature*, 470(7335), 479-485.
- Inter-American Development Bank, (2013). IDB Country Strategy with the Commonwealth of The Bahamas 2013–2017 Retrieved on 25th November, 2014 from:
<http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=38274385>
- IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp.
- IPCC, 2014: Summary for Policymakers. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.
- Jaja, J., & Dawson, J. (2014). What Contributes to Climate Change Adaptive Capacity? A Retrospective Case Study in a Caribbean Small Island Community. In *International Perspectives on Climate Change* (pp. 123-133). Springer International Publishing.
- Kelman, I., & West, J. J. (2009). Climate change and Small Island developing states: a critical review. *Ecological and Environmental Anthropology*, 5(1), 1-16
- King, D. A. (2004). Climate change science: adapt, mitigate, or ignore? *Science (Washington)*, 303(5655), 176-177.
- Klein, R. J., Nicholls, R. J., Ragoonaden, S., Capobianco, M., Aston, J., & Buckley, E. N. (2001). Technological options for adaptation to climate change in coastal zones. *Journal of Coastal Research*, 531-543.
- Kothari, U., & Cooke, B. (2001). Power, knowledge and social control in participatory development. *Participation: the new tyranny?* 139-152.

- Kumar, S., & Kumar, S. (2002). Methods for community participation: a complete guide for practitioners. *Methods for community participation: a complete guide for practitioners*.
- Lane, J. E. (2012). Climate Change Is Unavoidable. *Research in World Economy*, 3(2), p1.
- Mahon, R. (2002). Adaptation of fisheries and fishing communities to the impacts of climate change in the CARICOM region. *Prepared for the CARICOM Fisheries Unit, Belize City, Belize, as input to the planning process for the project Mainstreaming Adaptation to Climate Change (MACC) of the Caribbean Centre for Climate Change (CCCC)*.
- Mainstreaming Adaptation to Climate (2010). Mainstreaming Climate Change Adaptation into Sustainable Development
<http://www.caricom.org/jsp/projects/macc%20project/macc.jsp>
- Marchington, M., & Wilkinson, A. (2005). Direct participation and involvement. *Managing human resources: personnel management in transition*, 398-423.
- Masters, J. 2012 CRFM Statistics and Information Report -2010 66 pp
http://www.crfm.net/images/Rev_CRFM_Statistics_and_Inormation_Report_2010_revised_June_2014_for_website.pdf
- McFarlane, A. G. (2000). When inclusion leads to exclusion: The uncharted terrain of community participation in economic development. *Brook. L. Rev.*, 66, 861.
- McLeod, E., Poulter, B., Hinkel, J., Reyes, E., & Salm, R. (2010). Sea-level rise impact models and environmental conservation: A review of models and their applications. *Ocean & Coastal Management*, 53(9), 507-517
- McNamara, K. E. (2013). Raising awareness about climate change in Pacific communities. *Environmental Education Research*, 19(6), 864-871.
- Meehl, G. A., Covey, C., Taylor, K. E., Delworth, T., Stouffer, R. J., Latif, M., & Mitchell, J. F. (2007). The WCRP CMIP3 multimodel dataset: A new era in climate change research. *Bulletin of the American Meteorological Society*, 88(9), 1383-1394
- Medeiros D, H. Hove, M Keller, D Echeverría, Parry, (2011). Review of Current and Planned Adaptation Action: The Caribbean; *International Institute for Sustainable Development*

- Metz, B. (Ed.). (2001). Climate change 2001: mitigation: contribution of Working Group III to the third assessment report of the Intergovernmental Panel on Climate Change (Vol. 3). *Cambridge University Press*.
- Midgley, G. F., Hannah, L., Millar, D., Rutherford, M. C., & Powrie, L. W. (2002). Assessing the vulnerability of species richness to anthropogenic climate change in a biodiversity hotspot. *Global Ecology and Biogeography*, 11(6), 445-451.
- Moss, R. H., Edmonds, J. A., Hibbard, K. A., Manning, M. R., Rose, S. K., Van Vuuren, D. P., & Wilbanks, T. J. (2010). The next generation of scenarios for climate change research and assessment. *Nature*, 463(7282), 747-756.
- Newell, P. (2006). *Climate for change: Non-state actors and the global politics of the greenhouse*. Cambridge University Press.
- Newman, C. L., Howlett, E., Burton, S., Kozup, J. C., & Heintz Tangari, A. (2012). The influence of consumer concern about global climate change on framing effects for environmental sustainability messages. *International Journal of Advertising*, 31(3), 511- 527.
- Nogués-Bravo, D., & Rahbek, C. (2011). Communities under climate change. *Science*, 334(6059), 1070-1071.
- Notre Dame Global Adaptation Index, (2014) <http://www.gain.org/>
- Nurse, L. A. (2011). The implications of global climate change for fisheries management in the Caribbean. *Climate and Development*, 3(3), 228-241.
- O'Brien, K., Eriksen, S., Inderberg, T. H., & Sygna, L. (2014). 'Climate change and development: adaptation through transformation. *Climate Change Adaptation and Development: Transforming Paradigms and Practices*. Earthscan/Routledge. pp.
- Office of the Prime Minister (2001) Antigua and Barbuda's Initial National Communication on Climate Change
- Parry, M., Rosenzweig, C., Iglesias, A., Fischer, G., & Livermore, M. (1999). Climate change and world food security: a new assessment. *Global environmental change*, 9, S51-S67.
- Parry, M. L., Canziani, O. F., Palutikof, J. P., van der Linden, P. J., & Hanson, C. E. (2007). IPCC, 2007: climate change 2007: impacts, adaptation and vulnerability. Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change.

- Parry, M. L., Rosenzweig, C., Iglesias, A., Livermore, M., & Fischer, G. (2004). Effects of climate change on global food production under SRES emissions and socio-economic scenarios. *Global Environmental Change*, 14(1), 53-67.
- Parry, M., Arnell, N., McMichael, T., Nicholls, R., Martens, P., Kovats, S., & Fischer, G. (2001). Millions at risk: defining critical climate change threats and targets. *Global environmental change*, 11(3), 181-183.
- Paul, S. (1987). *Community participation in development projects*. Washington, DC: World Bank.
- Payet, R., & Agricole, W. (2006). Climate change in the Seychelles: implications for water and coral reefs. *AMBIO: A Journal of the Human Environment*, 35(4), 182-189.
- Pearsons, T. N., Li, H. W., & Lamberti, G. A. (1992). Influence of habitat complexity on resistance to flooding and resilience of stream fish assemblages. *Transactions of the American Fisheries society*, 121(4), 427-436.
- Phillips, M. C., Cinderich, A. B., Burrell, J. L., Ruper, J. L., Will, R. G., & Sheridan, S. C. (2015). The Effect of Climate Change on Natural Disasters: A College Student Perspective. *Weather, Climate, and Society*, 7(1), 60-68.
- Preston, B. L., Westaway, R. M., & Yuen, E. J. (2011). Climate adaptation planning in practice: an evaluation of adaptation plans from three developed nations. *Mitigation and Adaptation Strategies for Global Change*, 16(4), 407-438.
- Prevatt, D. O., Dupigny-Giroux, L. A., & Masters, F. J. (2010). Engineering perspectives on reducing hurricane damage to housing in CARICOM Caribbean Islands. *Natural Hazards Review*, 11(4), 140-150.
- Protocol, K. (1997). United Nations framework convention on climate change. Kyoto Protocol, Kyoto.
- Ragasa, C., Sun, Y., Bryan, E., Abate, C., Alemu, A., & Keita, M. N. (2013). *Organizational and Institutional Issues in Climate Change Adaptation and Risk Management: Insights from Practitioners Survey in Bangladesh, Ethiopia, Kenya, and Mali (Vol. 1279)*. Intl Food Policy Res Inst.
- Rao, N. D., Riahi, K., & Grubler, A. (2014). Climate impacts of poverty eradication . *Nature Climate Change*, 4(9), 749-751

- Reed, M. S. (2008). Stakeholder participation for environmental management: a literature review. *Biological conservation*, 141(10), 2417-2431.
- Roberts, C. M., Hawkins, J. P., & Gell, F. R. (2005). The role of marine reserves in achieving sustainable fisheries. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 360(1453), 123-132
- Rose, R. M. (2015). The Impact of Climate Change on Human Security in the Sahel Region of Africa.
- Roessig, Julie M., et al. "Effects of global climate change on marine and estuarine fishes and fisheries." *Reviews in Fish Biology and Fisheries* 14.2 (2004): 251-275.
- Salas, S., Chuenpagdee, R., Seijo, J. C., & Charles, A. (2007). Challenges in the assessment and management of small-scale fisheries in Latin America and the Caribbean. *Fisheries Research*, 87(1), 5-16.
- Sampei, Y., & Aoyagi-Usui, M. (2009). Mass-media coverage, its influence on public awareness of climate-change issues, and implications for Japan's national campaign to reduce greenhouse gas emissions. *Global Environmental Change*, 19(2), 203-212
- Sandals Foundation, (2014). Climate change adaptation projects in Antigua and Barbuda <http://www.sandalsfoundation.org/projects/climate-change-project-st-lucia-antigua.html>
- Santiso, C. (2001). World Bank and good governance: good governance and aid effectiveness: the World Bank and conditionality. *Geo. Public Pol'y Rev.*, 7, 1-137.
- Schipper, E. L. F. (2006). Conceptual history of adaptation in the UNFCCC process. *Review of European Community & International Environmental Law*, 15(1), 82-92.
- Schwartz, P., & Randall, D. (2003). *An abrupt climate change scenario and its implications for United States national security*. California Inst of Technology Pasadena Ca Jet Propulsion Lab.
- Scott, D., Amelung, B., Becken, S., Ceron, J. P., Dubois, G., Gössling, S., & Simpson, M. (2008). Climate change and tourism: Responding to global challenges. *World Tourism Organization*, Madrid, 230.
- Seth, S., & Villar, A. (2014). *The Measurement of Human Development and Poverty* (No. 14.10)

- Shackley, S., & Deanwood, R. (2002). Stakeholder perceptions of climate change impacts at the regional scale: implications for the effectiveness of regional and local responses. *Journal of Environmental Planning and Management*, 45(3), 381-402.
- Sharpe, A., & Conrad, C. (2006). Community based ecological monitoring in Nova Scotia: Challenges and opportunities. *Environmental Monitoring and Assessment*, 113(1-3), 395-409.
- Shelton, C. 2014. Climate change adaptation in fisheries and aquaculture – compilation of initial examples. *FAO Fisheries and Aquaculture Circular No. 1088*. Rome, FAO. 34 pp.
- Smith, J. B., Schneider, S. H., Oppenheimer, M., Yohe, G. W., Hare, W., Mastrandrea, M. D., & Van Ypersele, J. P. (2009). Assessing dangerous climate change through an update of the Intergovernmental Panel on Climate Change (IPCC) “reasons for concern”. *Proceedings of the National Academy of Sciences*, 106(11), 4133-4137.
- Statistics and Information Service of the Fisheries and Aquaculture Department/ Service (2012) FAO yearbook. Fishery and Aquaculture Statistics. 2010 Rome, FAO. 78 pp.
- Stern, N. (2008). The economics of climate change. *The American Economic Review*, 1-37.
- Stockholm Environment Institute (2011) Caribbean fisheries highly vulnerable to climate change, need to adapt. (Press Realise) Retrieved from 25th November 2014 <http://www.sei-international.org/mediamanager/documents/News/Press-releases/SEI-PressRelease-CaribbeanFisheriesHighlyVulnerableToClimateChangeNeedToAdapt-17nov2011.pdf>
- Sultana, P., & Abeyasekera, S. (2008). Effectiveness of participatory planning for community management of fisheries in Bangladesh. *Journal of environmental management*, 86(1), 201-213.
- Tosun, C. (2000). Limits to community participation in the tourism development process in developing countries. *Tourism management*, 21(6), 613-633.
- Thomas, D. S., & Twyman, C. (2005). Equity and justice in climate change adaptation amongst natural-resource-dependent societies. *Global Environmental Change*, 15(2), 115-124.

- Tompkins, E. L. (2005). Planning for climate change in small islands: insights from national hurricane preparedness in the Cayman Islands. *Global Environmental Change*, 15(2), 139-149.
- Tompkins, E. L., & Adger, W. N. (2005). Defining response capacity to enhance climate change policy. *Environmental Science & Policy*, 8(6), 562-571.
- Tol, R. S. (2009). The economic effects of climate change. *The Journal of Economic Perspectives*, 29-51.
- Tsamenyi, M., Palma, M. A., Milligan, B., & Mfodwo, K. (2009). Fairer fishing? The impact on developing countries of the European Community Regulation on illegal, unreported and unregulated fisheries. *Commonwealth Secretariat*
- UNDP, (2014.) Collaboration must be at the heart of climate action and sustainable development Retrieved from <http://www.undp.org/content/undp/en/home/blog/2014/12/12/Collaboration-must-be-at-the-heart-of-climate-action-and-sustainable-development.htm> 20th January, 2015
- UNESCO, (2013). UNESCO's Experts Meeting on Climate Change for Sustainable Development and Adaptation in Small Island Developing States (SIDS) http://www.sandwatch.ca/index.php?option=com_content&view=article&id=102:unesco-experts-meeting-nassau-bahamas-sept-21-23-2011&catid=19:international-conferences&Itemid=15
- United Nations Framework Convention on Climate Change (UNFCCC, 1992) and its Kyoto Protocol 1997.
- UN Water, 2014 http://www.unwater.org/statistics_use.html Retrieved, 12th April, 2015
- Urwin, K., & Jordan, A. (2008). Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance. *Global environmental change*, 18(1), 180-191.
- Van Aalst, M. K., Cannon, T., & Burton, I. (2008). Community level adaptation to climate change: The potential role of participatory community risk assessment. *Global environmental change*, 18(1), 165-179.
- VijayaVenkataRaman S, Iniyana S, Goic R (2012) A review of climate change mitigation and adaptation. *Renew and Sustain Ener Rev* 16: 878-897

- Waitt, G., & Hartig, K. (2000). Ecologically sustainable fishing in theory and practice: individual transferable quotas in Australia's South East Fishery. *Australian Geographer*, 31(1), 87-114
- Walther, G. R., Post, E., Convey, P., Menzel, A., Parmesan, C., Beebee, T. J., & Bairlein, F. (2002). Ecological responses to recent climate change. *Nature*, 416(6879), 389-395.
- Warner, K., Ehrhart, C., Sherbinin, A. D., Adamo, S., & Chai-Onn, T. (2009). In search of shelter: Mapping the effects of climate change on human migration and displacement. *In search of shelter: mapping the effects of climate change on human migration and displacement*.
- Wilbanks, T. J. (2003). Integrating climate change and sustainable development in a place-based context. *Climate Policy*, 3(sup1), S147-S154.
- Weiss, T. G. (2000). Governance, good governance and global governance: conceptual and actual challenges. *Third world quarterly*, 21(5), 795-814.
- Wellington, C. and R. Moore (eds.) (2001). Barbados' First National Communications to the United Nations Framework Convention on Climate Change (UNFCCC). St. Michael (Barbados): Ministry of Physical Development and Environment. Retrieved from http://unfccc.int/essential_background/library/items/3599.php?rec=j&preref=3229#beg
- World Bank. 2010b. World Development Indicators <http://data.worldbank.org/data-catalog/world-development-indicators/wdi-2010>
- World Bank. (2012). World Development Report 2013: Jobs. Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/11843> License: CC BY 3.0 IGO
- World Bank. (2013). World Development Indicators 2013 Washington, DC: World Bank. doi:10.1596/978-0-8213-9824-1. License: Creative Commons Attribution CC BY 3.0 <http://databank.worldbank.org/data/download/WDI-2013-ebook.pdf>
- World Health Organisation (2014), Climate Change Adaptation to Protect Human Health, Barbados project profile Retrieved on 22nd October, 2014 <http://www.who.int/globalchange/projects/adaptation/en/index1.html>
- WWF, (2010) the Living Planet Report http://d2ouvy59p0dg6k.cloudfront.net/downloads/1_lpr_2012_online_full_size_single_pages_final_120516.pdf

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary educational psychology*, 25(1), 82-91.

Appendix

ANTIGUA AND BARBUDA					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	3	Information on fisheries and community	"the public played a significant role in the policy	CPACC & James, 2002, pg.6 - 7
	2. UNFCCC Communications	2	Discussion on fisheries only in 1st & 2nd communications	"impacts on biomass and production of fisheries"	Gov't of Antigua and Barbuda, 2001
	3. National Acts and Legal Frameworks	2	Information on fisheries, no discussion on community	discusses stress in fisheries sector due to CC	Gov't of Antigua and Barbuda, 2009
	4. Climate Change Conventions	1	Nothing on fisheries or communities	signatories to UNFCCC's conventions	UNFCCC, 1997
		2/3			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/Unit	2	Information on fisheries, no communities	Fisheries Division, within the Ministry of Agric, Lands & Fisheries; National Meteorological Center	CPACC & James, 2002, pg.6 - 7
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	2	Committees on CC, information communities, nothing on fisheries	Technical advisory committee on CC with reports on NGOs and community participation	Gov't of Antigua and Barbuda 2010, pg 27
	7. Inter-Agency & Cross Sectorial Partnerships	2	Information on fisheries but not on community	Contribution of inter-agency collaborative groups but no evidence on climate change adaptation partnership document discusses fishery	Hailes et al., 2002; IISD, 2011, pg. 4
	8. Climate Change Mainstreaming Initiatives	1	No information on fisheries and community	CC mainstreaming activities and initiatives	UNPD, 2014
		3/5			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement	2	Communities in CCA, nothing on fisheries	Contribution from NGOs, CBOs	Gov't of Antigua and Barbuda 2010 pg 27
	10. Public Engagement	2	Communities in CCA, nothing on fisheries	National Capacity Self-Assessment (NCSA) helped to develop textbooks, student guides, environmental cert programs to help enhance local knowledge	Gov't of Antigua and Barbuda 2010 pg 26 -28
	11. Education and Awareness, Curriculum Dev.	2	Communities in CCA, nothing on fisheries	National Capacity Self-Assessment (NCSA) helped to develop textbooks, student guides, environmental cert programs to help enhance local knowledge	Gov't of Antigua and Barbuda 2010
		2/3			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities)	2	Information on fisheries but nothing on community	National Meteorological Center , CCCCC, Carbsave, CARDI, AUA, USHA	Gov't of Antigua and Barbuda, 2014
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	1	No information	Vulnerability assessment project and reports (general reports nothing on CC)	Hodgkinson-Chin, 2001
	14. Scientific Agency/National Assessments (NAPs/NAPs)	0	No information	No NAPA or NAPs	Gov't of Antigua and Barbuda, 2014
		1/3			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	Information on CC funds	No evidence if funds are available or accessible for fisheries or communities	Gov't of Antigua and Barbuda, 2014
	16. National Budgets (Sectorial Contributions)	1	National budgets for CC	Funds are generally focused on the economy. Nothing for fisheries and c'ties	Gov't of Antigua and Barbuda, 2014
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing,)	1	Funding information but not fishery or community focussed	"US\$ 4,212,910 that leveraged US\$4,898,300 in co-financing resources for eight national projects" as contribution from GEF	Gov't of Antigua and Barbuda, 2014
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	2	Information on community but not on fisheries	Sandals Foundation organised funding for tree planting (climate change project) in different communities.	Sandals Foundation, 2014
		3/7			
Science and Technology	19. Early Warning Tools And Technologies	1	Information available but nothing community or fishery	CC technologies and early warning systems very general not community or fisheries focussed	Challenger, 2002
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	2	Adequate information on community participation in rainwater harvesting and irrigation projects	rainwater harvesting projects in different communities. GIS map on community participation in rainwater harvesting	Map Atlas, 2009
	21. National Technology Needs Assessment Reports	1	Information available but nothing on fishery or community	Assesment based on national needs. No special focus on communities or fisheries.	UNFCCC, 2009
		4/9			

BAHAMAS					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	2	National document discusses fisheries, no information on community participation	Bahamas National Climate Change Policy, "promote alternative fishery and resource use activities",	BEST Commission, 2005; pg.12-13
	2. UNFCCC Communications	3	1st and 2nd communications have both fisheries and c'ties focussed	1st and 2nd National Communications (CC awareness creation, CACC projects targeted at communities, CPAAC involves community participation)	BEST Commission, 2001pg 47 and pg. 80
	3. National Acts and Legal Frameworks	2	National Act and Legal Framework on fisheries.	Fisheries acts and legal regulations for climate change adaptation eg Fisheries Act, 1977, Disaster Response Act, 2006	BEST Commission, 2005, pg. 12
	4. Climate Change Conventions	1	Nothing on fisheries or communities	Communities were not sensitised	BEST Commission, 2005; BEST Commission, 2001
		2/3			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/Unit	3	Information on fishery and community	Bahamas Env't, Science and Tech Ministry, Ministry of Social Services and Community Development; Ministry of Agric and Fisheries and Local Govt, The National Emergency Management Agency	BEST Commission, 2001
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	2	No information on fisheries and but committees and workshops on community participation.	Disaster Mgt Country Workshop for communities, Community Disaster Preparedness programs, National Climate Change Committee	Benjamin, 2011
	7. Inter-Agency & Cross Sectorial Partnerships	0	N/A	No information on inter-agency & cross sectorial partnerships; Not part of the Caribbean Adaptation partnership	N/A
	8. Climate Change Mainstreaming Initiatives	1	No information on fishery and community	MACC Projects aim at mainstreaming CC adaptation in sustainable dev't planning	MACC, 2010
		1/2			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	2	Information on community	GEF programs and projects in various c'ties. WWF International community participation programs. Bahamas NEMA	GEF, 2014; WWF, 2010
	10. Public Engagement	1	No information on fishery or community	Several public engagement projects	CCCCC, 2014
	11. Education and Awareness, Curriculum Dev.	2	No information on fishery but on community participation and awareness creation.	Bahamas National Coastal Awareness Committee deepening awareness and participation, CCCCC awareness creation programs and projects, The Bahamian Coral Reefs and Climate Change (community educational activities)	McPhee, 2014; CCCCC, 2014
		5/9			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	1	No information on community or fishery	Marine and Environmental Studies Institute provides national capacity for research and monitoring of marine and environmental resources, UWE	Gov't of Bahamas, 2014; University of West Indies, Caribsave, CCCCC, 2014
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	3	Information on terrestrial biodiversity and fisheries as well as community	CARIBSAVE climate change risk profile, Abaco Islands participated in CARIBSAVE's vulnerability assessment	CARIBSAVE, 2012; CCCCC, 2012
	14. Scientific Agency/National Assessments (NAPs/NAPs)	0	No NAPs/NAPA	N/A	N/A
		4/9			
Funding for Adaptation Planning	15. Climate Change and Adaptation Funds	1	No information on fishery or community	Bahamas received grants totaling US\$4,382,916; The Caribbean Development Bank (CDB); Inter-American Development Bank (IDB) funds.	GEF, 2010 ; IDB, 2013
	16. National Budgets (Sectorial Contributions)	0	No information	N/A	N/A
	17. Private Sector Contributions (Co-Funding, PPP, Green Leasing)	1	No information on fishery or community	GEF Funded projects, USD 4.3M ; Part of the USD56M GEF Grant, USD 650000 from IDB for feasibility study for CC resilient coastal zone mgt, Adaptation Fund (AF) \$62.39m; UK's International Climate Fund; Norway's International Climate and Forest Initiative	GEF, 2010 ; IDB, 2013
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	1	No information on fishery or community		Trujillo et al., 2013
		1/4			
Science and Technology	19. Early Warning Tools And Technologies	1	Information but has neither fishery nor community	Local Radar for tracking storms, Link with international radar to fine tune tracking in communities	Govt of Bahamas, 2013
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	3	Information on community and fishery	Domestic rain water harvesting equipment provided for communities, aquacultural activities, irrigation and post harvest technologies	Govt of Bahamas, 2013
	21. National Technology Needs Assessment Reports	3	Information on community and fishery	The National Capacity Needs Self-Assessment Project with evidence of fisheries and communities	SENES, 2005, pg. 8-19, BEST Commission, 2005
		7/9			

BARBADOS					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	1	Documents do not have fishery or community discussions	National adaptation strategy is directed to address climate change tourism sector	CCCCC, 2009; Gov't of Barbados, 2014
	2. UNFCCC Communications	3	Document contains fishery and community discussions	National communications contains discussions on impact on fishery as well as community involvement through educational activities.	Gov't of Barbados, 2001 pg. 39 and 44
	3. National Acts and Legal Frameworks	2	Documents have fishery but no community discussions	Coastal Zone Management Act; Fisheries Management Plan; Fisheries act	Gov't of Barbados, 2006 pg. 5
	4. Climate Change Conventions	1	Documents do not have fishery or community discussions	Various conventions and protocols on climate change	Gov't of Barbados, 2011
		3/5			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/Unit	2	Have fishery but no community agencies for climate change	Ministry of Energy and Environment; Barbados Met Services; Department of Emergency Management; Central Emergency Response Organization; Fisheries Unit; Coastal Zone Mgt Unit	Gov't of Barbados, 2011
	6. Climate Change Committee/Working Group/Task Force/Ad Hoc	2	Documents do not show fishery but have community discussions	National CC Committee; Natural Heritage Dept	CRFM, 2012
	7. Inter-Agency & Cross Sectorial Partnerships	3	Document contains fishery and community discussions	Public awareness campaigns; Conduct monitoring and research activities for fisheries	Medeiros et al., 2011; IISD, 2011
	8. Climate Change Mainstreaming Initiatives	1	Documents do not have fishery or community discussions	Mainstreaming Adaptation to Climate Change: (MACC)	MACC. 2012
		2/3			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	1	Activities do not have information on fishery or community	UNEP Global Environment Facility (GEF), Inter American Development Bank (IDB), Conference-Workshop in Climate change Initiative USAID	UNEP, 2010; GEF 2011; USAID, 2012
	10. Public Engagement	2	Activities involve community participation but nothing on fisheries	UNESCO experts meeting on climate change education; Barbados Environmental Society; MACC adopted a learning-by-doing approach to capacity building	UNESCO, 2011, Pg.11
	11. Education and Awareness, Curriculum Dev.	2	Activities involve community participation but nothing on fisheries	UNESCO experts meeting on climate change education, Pilot implementation of the program followed in teacher training institutions	UNESCO, 2013
		5/9			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	3	Document contains fishery and community discussions	Centre for Environmental Resource and Management Studies, UWE; Barbados Environmental Society; CARIBSAVE; CCCCC	CARIBSAVE, 2012; CCCCC, 2013; CRFM, 2012
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	2	Have fishery but no community agencies for climate change	CPACC Project Database; IPCC Report; CRFM database; CARIBSAVE Vulnerability Hotspots	CARIBSAVE, 2012; CCCCC, 2013; CRFM, 2012
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	1	Document do not have information on fishery or community	General reprint on Barbados and climate change adaptation.	Gov't of Barbados, 2010
		2/3			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	Document do not have information on fishery or community	IDB grant for Sustainable Energy Framework; GEF/UNEP; DFID/AusAID grant;	UNEP, 2010
	16. National Budgets (Sectorial Contributions)	1	Document do not have information on fishery or community	National budget no focus on climate change adaptation	Govt of Barbados, 2014
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing.)	1	Document do not have information on fishery or community	Green Funding form GEF, GEF Funded projects, USD 1m ; USD 80m GEF Grant, USD 45m loan from IDB for renewable energy	CCCCC, 2010; ECLAC, 2011; GEF, 2014; IDB, 2010
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	1	Document do not have information on fishery or community	Green Funding form GEF, GEF Funded projects, USD 1m ; USD 80m GEF Grant, USD 45m loan from IDB for renewable energy	CCCCC, 2010; ECLAC, 2011; GEF, 2014; IDB, 2010
		1/3			
Science and Technology	19. Early Warning Tools And Technologies	2	Projects have information on community but not fishery	Photovoltaic Systems, Solar Panels, Renewable energy Initiatives	Hutchison, 2010 pg. 7-8 ; Caribesave, 2012. pg. 9 ;
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	2	Projects have information on community but not fishery	Agricultural and irrigation facilities for communities	Govt of Barbados, 2012
	21. National Technology Needs Assessment Reports	2	Projects have information on community but not fishery	Photovoltaic Systems, Solar Panels, Renewable energy Initiatives	Hutchison, 2010 pg. 7-8 ; Caribesave, 2012. pg. 9 ;
		2/3			

CUBA					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	3	Information on fishery or community	National environmental strategy; Action Plan on Adaptation to Climate Change	Gobierno de Cuba, 2012
	2. UNFCCC Communications	3	Document discusses community participation and fishery	Capacity building, education and public awareness	Gobierno de Cuba, 2012; Centella et al, 2001
	3. National Acts and Legal Frameworks	3	Document discusses community participation and fishery	National Commission on Climate Change; National Fishery Act	Oxfam, 2011; Gobierno de Cuba, 2012
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	Communities have not been engaged in conventions and protocols for CC adaptation.	Gobierno de Cuba, 2012
		5/6			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	2	No information on community but document discusses fishery	Ministry of Science, Technology and Environment; Ministry of Fishing Industry; Fisheries Regulations Division; Cuban Institute of Meteorology; National Watershed Council	Gobierno de Cuba, 2012
	6. Climate Change Committee/Working Group/Task Force/Ad Hoc	3	No information on fishery or community	National Commission on Climate Change	NCCC, 2012
	7. Inter-Agency & Cross Sectorial Partnerships	3	No information on fishery or community	Capacity Building for Stage II Adaptation to Climate Change; Climate Change Vulnerability Evaluation of Coastal and Marine Areas	RIOCC, 2012
	8. Climate Change Mainstreaming Initiatives	2	No information on fishery but document discusses community participation	Workshop on Climate Change Adaptation, Development and Disaster Risk Reduction	UNDP, 2012
		5/6			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	2	Information on community but not fishery	National Group of Climate Change; Ibero-American Network of Climate Change; ProNATURALEZA; Oxfam	RIOCC, 2013; IISD, 2011; Oxfam; 2012
	10. Public Engagement (Town Hall meetings, consultations)	1	No information on fishery or community	N/A	N/A
	11. Education and Awareness, Curriculum Dev.	3	Adequate information on fishery and community	Cuban Research Institute (CRI)	Gobierno de Cuba, 2012
		2/3			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	3	No information on fishery or community	Cuban Academy of Sciences; OXFAM Research; Cuban Research Institute (CRI); Institute of Fundamental Research in Tropical Agriculture; Institute of Ecology and Systematics; National Watershed Council	INIFAT; 2014; OXFAM; 2013
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	1	No information on fishery or community	Risk Mapping: CANARI risk assessment; Center for Risk Reduction Management, Güira de Melena	CANARI, 2010
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	1	No information on fishery or community	Cuban Academy of Sciences	UNFCCC, 2001
		5/9			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery and community	(FAO) funds aimed to improve emergency preparedness; GEF funded projects (USD\$50m)	FAO, 2013; GEF, 2012
	16. National Budgets (Sectorial Contributions)	1	No information on fishery and community	National Environment Fund (no evidence of community accessibility)	FAO, 2013; GEF, 2012
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing.)	1	No information on fishery and community	FAO funds; GEF funds	FAO, 2013; GEF, 2012
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	1	No information on fishery and community	CARE is currently funding an adaptation projects. (FAO) aimed to improve emergency preparedness; UNDP has 17 collaborative projects in Cuba with total investment of about \$USD45m	CARE, 2013; UNDP, 2013
		1/3			
Science and Technology	19. Early Warning Tools And Technologies	3	No fishery but information on community	National Civil Defense System; sophisticated national disaster risk reduction framework; Center for Risk Reduction Management, Güira de Melena	Gobierno de Cuba, 2012
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	3	No information on fishery but communities are involved in rain water harvesting projects	Two-days exercise called "Meteoro"	Gobierno de Cuba, 2012
	21. National Technology Needs Assessment Reports	2	No information on fishery but communities are involved	stakeholder engagement activities	Gobierno de Cuba, 2012 CITMA, 2011
		8/9			

DOMINICA					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	2	Information on fishery nothing on community	Climate Change Adaptation Policy and Action Plan; National Disaster Plan; Fisheries Management Plan	Gov't of Dominica, 2012
	2. UNFCCC Communications	2	Information on fishery nothing on community	1st and 2nd Communications-Fisheries Development	Gov't of Dominica, 2012
	3. National Acts and Legal Frameworks	2	Information on fishery nothing on community	National Disaster Plan; National Disaster Management Act; Fisheries Act of 1987	Gov't of Dominica, 2012
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	Several CC conventions and protocols	Gov't of Dominica, 2012
		3/5			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	2	Information on fishery but nothing on community	Ministry of Environment, Natural Resource, Physical Planning and Fisheries; Office of Disaster Management; National Emergency Planning Organisation; Ministry of Public Utilities	Gov't of Dominica, 2012
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	1	No information on community or fishery	National Climate Change Steering Committee; Technical Working Groups on CC; National Consultative Workshop	UNFCCC, 2012; Gov't of Dominica, 2012
	7. Inter-Agency & Cross Sectorial Partnerships	2	Information on fishery but nothing on community	Sectorial consultative workshops and partnerships; IISD Adaptation Partnerships	Medeiros et al, 2011; IISD, 2011; Gov't of Dominica, 2013
	8. Climate Change Mainstreaming Initiatives	1	No information on fishery or community	Mainstreaming Adaptation to Climate Change in Dominica	CCCCC, 2012
		1/2			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	1	No information on fishery or community	Pilot Program for Climate Resilience; IDB programs on CC	Gov't of Dominica; IDB, 2012
	10. Public Engagement	2	Information on fishery but nothing on community	National Fishers Cooperative; National Consultative Workshop	UNFCCC, 2012
	11. Education and Awareness, Curriculum Dev.	0	No information	N/A	N/A
		1/3			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	2	Information on fishery nothing on community	Caribbean Regional Fisheries Mechanism; CARDI; CCCCC; Caribsave	CRFM, 2012; CCCCC 2012; Caribsave, 2012
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	2	Information on fishery nothing on community	CARIBSAVE's vulnerability assessment	CRFM, 2012; Caribsave, 2012
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	0	NA	NA	NA
		4/9			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery or community	Climate Investment Funds, World Bank, Government of Dominica received GEF grants totaling US\$1m	Gov't of Dominica, 2012; GEF, 2011
	16. National Budgets (Sectorial Contributions)	1	No information on fishery or community		
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing)	1	No information on fishery or community	World Bank's Strategic Climate Fund; GEF grants;	World Bank, 2012; GEF, 2011
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral agreements	1	No information on fishery or community	World Bank's Strategic Climate Fund; GEF grants;	World Bank, 2012; GEF, 2011
		1/3			

DOMINICAN REPUBLIC					
COMPONENTS	INDICATORS	SCORE	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	1	No information on fishery or community	National Development Strategy	Gobierno de la República Dominicana, 2013
	2. UNFCCC Communications	1	No information on fishery or community	1st and 2nd Communications	UNFCCC, 2003; Gobierno de la República Dominicana, 2013
	3. National Acts and Legal Frameworks	2	Acts and Frameworks on fishery nothing on community	National System for Prevention, Mitigation and Response to Disasters; Dominican Council for Fisheries and Aquaculture	Gobierno de la República Dominicana, 2013
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	1st and 2nd Communications	Gobierno de la República Dominicana, 2013
		3/7			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	2	Information on fishery nothing on community	Ministry of Environment and Natural Resources; National Meteorology Office (ONAMET); Climate Change Unit; Dominican Council of Fisheries and Aquaculture; Ministry of Economy, Planning and Development; National Council on Climate Change and Clean Development Mechanism	Gobierno de la República Dominicana, 2013
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	2	Information on fishery nothing on community	National Climate Change Council; National Commission for Emergencies; Dominican Council of Fisheries and Aquaculture; The National Council on Climate Change and Clean Development Mechanism	Gobierno de la República Dominicana, 2013;
	7. Inter-Agency & Cross Sectorial Partnerships	1	No information on fishery or community	Inter-institutional Commission on Climate Change	Gobierno de la República Dominicana, 2013;
	8. Climate Change Mainstreaming Initiatives	1	No information on fishery or community	Climate Compatible Development Plan; Integrating Climate Change Adaptation into National Development Processes	Gobierno de la República Dominicana, 2013; Medeiros et al, 2011; IISD, 2011
		1/2			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	2	Information on community nothing on fishery	USAID supported land use programs; The Nature Conservancy; PRONATURA, USAID; UNDP; GIZ	USAID/Dominican Republic, 2013; Medeiros et al, 2011; IISD, 2011
	10. Public Engagement	2	Information on fishery nothing on community	USAID/Dominican Republic; Marina de Guerra, fishing associations Wide consultation meetings	ARCC, 2013
	11. Education and Awareness, Curriculum Dev.	2	Information on community nothing on fishery	UNFCCC and Partners Launch UN Alliance on Climate Change Education, Training and Awareness	USAID/Dominican Republic, 2013; UNFCCC, 2012
		2/3			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	2	Information on fishery but not community	The Caribsave Climate Change Risk Atlas (CCRA); Technological Institute of Santo Domingo	Caribsave, 2012
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	1	No information on fishery or community	The Caribsave Climate Change Risk Atlas (CCRA);	Caribsave, 2012
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	1	No information on fishery or community	National Adaptation Plan of Action	Gobierno de la República Dominicana, 2013
		4/9			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery or community	GEF-Trust Fund (\$1.4 million)	Ministerio de Hacienda de la República Dominicana, 2011
	16. National Budgets (Sectorial Contributions)	2	Information on community but not on fishery	1 million USD from the national budget in climate change training for teachers in 2014-2016	UNITAR, 2014
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing.)	2	Information on community but not on fishery	GEF-Trust Fund; USAID \$2.4m; Sur Futuro Foundation	GEF, 2012; USAID, 2013; UNITAR, 2014
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	2	Information on community but not on fishery	GEF-Trust Fund; USAID \$2.4m; Sur Futuro Foundation	GEF, 2012; USAID, 2013; UNITAR, 2014
		3/5			
Science and Technology	19. Early Warning Tools And Technologies	1	No information on fishery or community	Early Warning System Networks	Gobierno de la República Dominicana, 2013
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	2	Information on community but not on fishery	Technical team composed of national and international experts; rainwater harvesting and piped water systems comparoons	Gobierno de la República Dominicana, 2013; Biehl, 2012
	21. National Technology Needs Assessment Reports	2	Information on community but not on fishery	Dominican Republic Climate Change Vulnerability Assessment Report; Consejo Dominicano de Pesca y Acuicultura	ARCC, 2013
		5/9			

GRENADA					
COMPONENTS	INDICATORS	SCORE	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	3	Information on fishery and community	Strategic Program for Climate Resilience; National Climate Change Policy and Action Plan; Community level presentations, discussions and public fora on climate change and its implications	Gov't of Grenada, 2007
	2. UNFCCC Communications	3	Information on fishery and community	CC impact on fishery; community education and mobilization; human resource development training for community groups	Gov't of Grenada, 2000, pg.45; Charles, 2000
	3. National Acts and Legal Frameworks	2	Acts and Frameworks on fishery nothing on community	Fisheries Laws; National Water Policy 2007	Gov't of Grenada, 2011
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	1st national Communications	UNFCCC, 2000
		3/4			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	3	Information on fishery and community	National Disaster Management Agency; Ministry of Agriculture, Forestry & Fisheries; Ministry of Housing, Lands & Community Devt; Ministry Of Environment, Foreign Trade, Export Development; Fisheries Division of Grenada	Gov't of Grenada, 2013
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	2	Information on community nothing on fishery	National climate change committee; Damage Assessment and Needs Analysis Committee; The Environmental Management Committee	Gov't of Grenada, 2013
	7. Inter-Agency & Cross Sectorial Partnerships	1	No information on fishery or community	UNDP Climate Change Country Profiles	UNDP, 2011;
	8. Climate Change Mainstreaming Initiatives	1	No information on fishery or community	Integrated Climate Change Adaptation Strategies	Gov't of Grenada, 2013; GIZ & UNDP, 2012
		3/5			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	2	Information on community nothing on fishery	Community level presentations, discussions and public fora on climate change and its implications	Gov't of Grenada, 2012; Medeiros et al, 2011; IISD, 2011
	10. Public Engagement	2	Information on community nothing on fishery	Community Mobilization and Active Civil Society Involvement	CDB & CDERA, 2003
	11. Education and Awareness, Curriculum Dev.	2	Information on community nothing on fishery	Effective Education and Public Awareness Programs; Community Education and Awareness programs; Grenadian Youngsters Raise Awareness About Climate Change	CDB & CDERA, 2003; CCCCC, 2013
		2/3			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	2	Information on fishery nothing on community	St. George's University; Climate Change Risk Atlas; CCCCC, Agency for Reconstruction and Development	CARIBSAVE, 2012; Simpson et al 2012
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	0	NA	NA	NA
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	3	Information on fishery and community	National Capacity Self Assessment Projects	Thomas, 2005; Ellard-Deveney, 2006
		5/9			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery or community	Grant: US\$8.0 million; Climate Investment Funds	Gov't of Grenada, 2013
	16. National Budgets (Sectorial Contributions)	3	Budget allocations for fishery and community	Fisheries allocations: fishing community, community	Gov't of Grenada, 2013
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing.)	1	World Bank, IDB, GEF	The World Bank US\$ 25.2 m; IDB, 2013	IDB, 2013; World Bank, 2013
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	1	World Bank, IDB, GEF	The World Bank US\$ 25.2 m; IDB, 2013	IDB, 2013; World Bank, 2013
		1/2			
Science and Technology	19. Early Warning Tools And Technologies	2	Information on community nothing on fishery	Public awareness of CC technological needs	UNDESA, 2012
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	2	Information on community nothing on fishery	RWH in Northern Grenada; public awareness of CC technology is high; Science and Technology Council Act	UNDESA, 2012
	21. National Technology Needs Assessment Reports	3	information on community and fishery	National Capacity Self Assessment Cross Cutting Analysis	Gov't of grenada, 2006
		7/9			

JAMAICA					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	3	Information on fishery and community	Jamaica National Strategy and Action Plan; Jamaican Climate change Policy	Gov't of Jamaica, 2012; Protz, 2012, pg. 12 and Pg. 15
	2. UNFCCC Communications	3	Information on fishery and community	1st and 2nd National Communications	Gov't of Jamaica, 2013, pg. 40
	3. National Acts and Legal Frameworks	2	Information on fishery nothing on community	Fishing Industry Act of 1975; National Water Sector Policy; Climate Change Policy Framework and Action Plan	Gov't of Jamaica, 2013
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	Kyoto Protocol Signed in 1999, Ratification in 2005	Gov't of Jamaica, 2013
		3/4			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	3	Information on fishery and community	Ministry of Agric and Fisheries; Ministry of Water, Land, Env't and Climate Change; Meteorological Service; National Environment and Planning Agency, Beach Control Authority; Office of Disaster Preparedness and Emergency Management.	Gov't of Jamaica 2005
	6. Climate Change Committee/Working Group /Task Force/Ad Hoc	1	No information on fishery or community	National Disaster Committee; Climate Change Advisory Committee	Gov't of Jamaica 2005
	7. Inter-Agency & Cross Sectorial Partnerships	2	Information on fishery nothing on community	Climate Change incorporated into Environment Ministry and Fisheries into Agricultural Ministry	Medeiros et al., 2011; IISD, 2011; Gov't of Jamaica 2005
	8. Climate Change Mainstreaming Initiatives	1	No information on fishery or community	Coral Reef Monitoring for Climate Change Impacts Jamaica 2001-2003,	CCCCC, 2010; Creary, 2006
		3/5			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	1	No information on fishery or community	UNEP, Global Environment Facility (GEF), Inter American Development Bank (IDB), UNFCCC, UNESCO; CCCCC	UNEP, 2010; UNESCO, 2009; IDB, 2013; Medeiros et al., 2011; IISD, 2011
	10. Public Engagement	2	Information on community nothing on fishery	Public education outreach sub-committees; Glengoffe Climate Change Adaptation	Benjamin, 2011
	11. Education and Awareness, Curriculum Dev.	2	Information on community nothing on fishery	(NGO) Panos is doing a quick analysis on Adaptation perception;	UNESCO, 2009 pg. 2
		5/9			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	2	Information on fishery nothing on community	University of West Indies; Caribsave, CCCCC; C-Fish	UWI, 2014; CCCCC, 2014
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	2	Information on fishery and community	Climate Change risk profile, Climate Change Atlas	Caribsave, 2012
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	3	Information on fishery and community	Jamaica national assessment report	Gov't of Jamaica, 2004
		7/9			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery or community	GEF Funded projects, USD 4.3M; Part of the USD56M GEF Grant, USD 650000 from IDB for feasibility study for CC resilient coastal zone mgt, but it's more accessible to governments than communities	GEF, 2010; IDB, 2013
	16. National Budgets (Sectorial Contributions)	0	NA	NA	NA
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing.)	1	No information on fishery or community	GEF Funded projects, USD 4.3M; Part of the USD56M GEF Grant, USD 650000 from IDB for feasibility study for CC resilient coastal zone mgt, No information on community	GEF, 2010; IDB, 2013
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	1	No information on fishery or community	GEF; World Bank: IDB	GEF, 2010; IDB, 2013
		1/4			
Science and Technology	19. Early Warning Tools And Technologies	2	Information on community nothing on fishery	Local Radar for tracking storms, Link with international radar to fine tune tracking in communities	Gov't of Jamaica, 2013
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural/Coastal)	2	Information on community nothing on fishery	Water harvesting and Irrigation Facilities for local communities	Gov't of Jamaica, 2013
	21. National Technology Needs Assessment Reports	2	Information on community and fishery	Workshop on TNA: Evidence of Community involvement	Gov't of Jamaica, 2004; Ministry of Land and Environment; 2003
		2/3			

ST KITTS AND NEVIS					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	2	Information on community nothing on fishery	National Preparatory Process for Rio+20; National Environmental Management Strategy	Gov't of St Kitts & Nevis, 2012
	2. UNFCCC Communications	3	Information on fishery and community	1st National Communication	UNFCCC, 2000; Gov't of St Kitts & Nevis, 2012
	3. National Acts and Legal Frameworks	1	No information on fishery or community	National Environmental Management Strategy; National Conservation and Environmental Protection Act	Gov't of St Kitts & Nevis, 2012
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	Ratified by St. Kitts and Nevis in 1993	Gov't of St Kitts & Nevis, 2012
		3/5			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	2	Information on fishery nothing on community	Fisheries Division; Island Planning Services; Department of Physical Planning, National Resources and the Environment; Ministry of Health and Environment; Ministry of Sustainable Development	Gov't of St Kitts & Nevis, 2012
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	1	No information on fishery or community	Global Climate Change Alliance (GCCA); Nevis Disaster Management	Gov't of St Kitts & Nevis, 2012
	7. Inter-Agency & Cross Sectorial Partnerships	1	No information on fishery or community	Review of Current and Planned Adaptation Action; Global Climate Change Alliance (GCCA); MACC and SPACC projects	Medeiros et al, 2011; IISD, 2011
	8. Climate Change Mainstreaming Initiatives	1	No information on fishery or community	National environmental summary; disaster risk reduction into sustainable development policies	UNEP, 2010; NEMA, 2013
		3/7			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	2	Information on fishery nothing on community	Cooperation between European Union and St. Kitts and Nevis; CCCCC; Caribsavé projects; Country-Specific Programs; CARDI	Government of St Kitts and Nevis, 2014; CARDI, 2009
	10. Public Engagement	1	No information on fishery or community	National Preparatory Process	Gov't of St Kitts & Nevis, 2012
	11. Education and Awareness, Curriculum Dev.	2	Information on community nothing on fishery	Ministry of Education - St. Kitts & Nevis. St. Kitts - Nevis Climate Change and Ethical Principles program	Gov't of St Kitts & Nevis, 2014
		5/9			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	2	Information on fishery nothing on community	CARDI; CCCCC; Caribsavé; University of the West Indies;	CARDI, 2009; Caribsavé, 2012
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	2	Information on community nothing on fishery	Hazard Vulnerability Assessment: Final Report	Gov't of St. Kitts & Nevis, 2001
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	2	Information on community nothing on fishery	National Action Plan (NAP); National Capacity Self Assessment Final Report	
		2/3			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery or community	Clean Technology Fund; Caribbean Development Bank funds; World Bank; IDB funds; GEF	CDB, 2014; World Bank, 2013; IDB, 2014; GEF, 2012
	16. National Budgets (Sectorial Contributions)	1	No information on fishery or community	St Kitts & Nevis Climate Change Budget	Gov't of St. Kitts & Nevis, 2014
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing,)	1	No information on fishery or community	USAID; GEF; World Bank	GEF, 2012; USAID, 2013
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	1	No information on fishery or community	St. Christopher National Trust	Gov't of St. Kitts & Nevis, 2014
		1/3			
Science and Technology	19. Early Warning Tools And Technologies	1	No information on fishery or community	Early Warning System for Agricultural Drought;	Gov't of St. Kitts & Nevis, 2001
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	2	Information on community nothing on fishery	Climate change financing and technology transfer program; Rainwater harvesting and irrigation	Gov't of St. Kitts & Nevis, 2001
	21. National Technology Needs Assessment Reports	2	Information on community nothing on fishery	National Capacity Self Assessment Final Report	Gov't of St. Kitts & Nevis, 2001
		5/9			

ST LUCIA					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	3	Information on fishery and community	Rio+20 National synthesis report; Sustainable Energy Plan; Fourth National Report; National Climate Change Policy and Adaptation Plan	Gov't of St. Lucia, 2009; Gov't of St. Lucia 2013
	2. UNFCCC Communications	3	Information on fishery and community	1st and 2nd communications	UNFCCC, 2001; UNFCCC, 2011; Gov't of St. Lucia, 2013
	3. National Acts and Legal Frameworks	2	Information on fishery nothing on community	Fisheries Act and Regulations; Fisheries Management Act; National Environment Policy; National Climate Change Policy and Adaptation Plan	Gov't of St. Lucia, 2009; Gov't of St. Lucia 2013
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	No evidence of community awareness	Gov't of St. Lucia, 2009; Gov't of St. Lucia 2013
		3/4			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	3	Information on fishery and community	Ministry of Agric, Forestry and Fisheries; Ministry of Sustainable Dev't, Science and Tech; Department of Fisheries; National Emergency Management Organization; Division for Early Warning and Assessment	Gov't of St. Lucia, 2009; Gov't of St. Lucia, 2013
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	2	Information on community nothing on fishery	National Stakeholder's Workshop; National Environmental Commission; St. Lucia National Trust	UNFCCC, 2011; Gov't of St. Lucia 2013
	7. Inter-Agency & Cross Sectorial Partnerships	2	Information on community nothing on fishery	Adaptation partnership projects and Review of Current and Planned Adaptation Action; MACC and SPACC projects	Medeiros et al., 2011; IISD, 2011
	8. Climate Change Mainstreaming Initiatives	3	Information on fishery and community	Workshop on Mainstreaming Climate Change into National Planning and Budgetary Process	MSDEST, 2012;
		5/6			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	2	Information on community nothing on fishery	Workshop in Mainstreaming Climate Change into National Planning and Budgetary Process; Climate Change Public Education Strategy	MSDEST, 2012; Gov't of St. Lucia, 2013
	10. Public Engagement	2	Information on community nothing on fishery	Public awareness and education; Climate Change Public Education Strategy	Gov't of St. Lucia, 2013
	11. Education and Awareness, Curriculum Dev.	2	Information on community nothing on fishery	Public awareness and Climate Change Education; Climate Change Public Education Strategy	Gov't of St. Lucia, 2013
		2/3			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	3	Information on fishery and community	CARIBSAVE; CANARI; CCCCC	CARIBSAVE, 2012; CANARI, 2012; CCCCC, 2012
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	2	Information on community nothing on fishery	CARIBSAVE climate change risk profile	CARIBSAVE, 2012
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	1	No information on fishery or community	Review of progress made by Saint Lucia in addressing vulnerabilities of SIDS; NAPs	Gov't of St. Lucia, 2013
		2/3			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery or community	GEF; United Nations Foundation, World Bank, Caribbean Catastrophe Risk Insurance Facility; USAID	GEF, 2013; World Bank, 2013; USAID, 2012
	16. National Budgets (Sectorial Contributions)	1	No information on fishery or community	Budgetary allocations for CCA	Gov't of St. Lucia, 2013
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing.)	1	No information on fishery or community	GEF; United Nations Foundation, World Bank, Caribbean Catastrophe Risk Insurance Facility; USAID \$1.5 million to support adaptation to CCA	GEF, 2013; World Bank, 2013; USAID, 2012
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	1	No information on fishery or community	United Nations Foundation; GEF; , World Bank, Caribbean Catastrophe Risk Insurance Facility; USAID	GEF, 2013; World Bank, 2013; USAID, 2012
		1/3			
Science and Technology	19. Early Warning Tools And Technologies	2	Information on community nothing on fishery	Division for Early Warning and Assessment; hazard maps	Gov't of St. Lucia, 2013
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	2	Information on community nothing on fishery	hazard maps; Rain Water Harvesting projects; irrigation projects	Gov't of St. Lucia, 2013
	21. National Technology Needs Assessment Reports	2	Information on community nothing on fishery	Climate Change Technology Needs Assessment; Biodiversity Needs Assessment	Gov't of St. Lucia, 2013
		2/3			

SAINT VINCENT AND THE GRENADINES					
COMPONENTS	INDICATORS	SCORES	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	2	Information on community nothing on fishery	National Report; Strategic Programme for Climate Resilience; Disaster Vulnerability Reduction Project; National Environmental Management Strategy; National Adaptation Strategy; National Environmental Action Plan; National Environmental Summary	Gov't of St Vincent & Grenadines; 2004; UNEP, 2010
	2. UNFCCC Communications	3	Information on community and fishery	Initial National Communication on Climate Change	Gov't of St Vincent & Grenadines, 2000
	3. National Acts and Legal Frameworks	3	Information on community and fishery	Disaster vulnerability reduction project; Resettlement Policy Framework; Fisheries Act	Gov't of St Vincent & Grenadines, 2011
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	No evidence of community awareness	Gov't of St Vincent & Grenadines, 2000
		3/4			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	2	Information on fishery nothing on community	National Environmental Advisory Board; Ministry of Health and the Environment; Ministry of Agriculture, Forestry and Fisheries ;Meteorological Service	Gov't of St Vincent & Grenadines, 2000
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	1	No information on fishery or community	The Nature Conservancy	Gov't of St Vincent & Grenadines, 2000; Caribsave, 2012
	7. Inter-Agency & Cross Sectorial Partnerships	1	No information on fishery or community	Inter-Agency Collaborative Group; Adaptation partnership; MACC and SPACC projects	Medeiros et al, 2011; IISD, 2011
	8. Climate Change Mainstreaming Initiatives	1	No information on fishery or community	Mainstream climate change adaptation strategies into its sustainable development agenda	Gov't of St Vincent & Grenadines, 2000
		3/7			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	2	Information on community nothing on fishery	Country Strategy Paper and National Indicative Programme; damage assessment, shelter management, relief supplies management	Gov't of St Vincent & Grenadines, 2000; Caribsave, 2012
	10. Public Engagement	2	Information on community nothing on fishery	40 local community disaster committees; community education and capacity building initiative	Gov't of St Vincent & Grenadines, 2000; Caribsave, 2012
	11. Education and Awareness, Curriculum Dev.	2	Information on community nothing on fishery	development of educational programmes; national education program	Gov't of St Vincent & Grenadines, 2000; Caribsave, 2012
		2/3			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	2	Information on fishery nothing on community	Caribbean Regional Research Diagnostic; CARDI, CARIBSAVE	CARDI, 2012; Caribsave 2012
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	2	Information on fishery nothing on community	CARIBSAVE Climate Change Risk Profile; UNFCCC vulnerability	Caribsave 2012; UNFCCC, 2000
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	1	No information on fishery or community	ECLAC Assessment of the economic impact of climate change	ECLAC, 2011
		5/9			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery or community	GEF; World Bank; U.S. Climate Finance	GEF,2010; World Bank,2012
	16. National Budgets (Sectorial Contributions)	1	No information on fishery or community	Natinal budget	Gov't of St Vincent & Grenadines, 2014
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing,)	1	No information on fishery or community	U.S. Climate Finance: GEF; World Bank	GEF,2010; World Bank,2012
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	1	No information on fishery or community	Pan American Development Foundation	Gov't of St Vincent & Grenadines, 2014
		1/3			
Science and Technology	19. Early Warning Tools And Technologies	2	Information on community nothing on fishery	early warning systems from Met service; land-suitability and hazard mapping.	Gov't of St Vincent & Grenadines, 2014
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	2	Information on community nothing on fishery	Early Warning Systems for disaster risk reduction enhanced at the community and national levels	CARIBSAVE, 2012
	21. National Technology Needs Assessment Reports	1	No information on fishery or community	National Technology Needs Assessment Reports	Gov't of St Vincent & Grenadines, 2002
		5/9			

TRINIDAD AND TOBAGO					
COMPONENTS	INDICATORS	SCORE	NOTES	JUSTIFICATION	REFERENCES
Political Leadership for Adaptation	1. National Strategy Paper	2	Information on fishery nothing on community	National climate change policy; Country paper on CC;	Gov't of Trinidad and Tobago, 2011; UNEP, 2010
	2. UNFCCC Communications	3	Information on community and fishery	1st and 2nd communications	Gov't of Trinidad and Tobago, 2013
	3. National Acts and Legal Frameworks	2	Information on fishery nothing on community	Fisheries Policy; Draft climate change policy; National Environmental Policy	Gov't of Trinidad and Tobago, 2013
	4. Climate Change Conventions and Protocols	1	No information on fishery or community	No evidence of community awareness creation on the protocols	Gov't of Trinidad and Tobago, 1999
		2/3			
Institutional Organisation for Adaptation	5. Lead Ministry/Department/Agency/unit	2	Information on fishery nothing on community	Institute of Marine Affairs; Ministry of Env't and Water Resources; Environmental Mgt Authority; Office of Disaster Preparedness and Management; National Emergency Management Agency; National Emergency Relief Organisation; Trinidad and Tobago Meteorological Service	Gov't of Trinidad and Tobago, 2013
	6. Climate Change Committee/Working Group / Task Force/Ad Hoc	2	Information on community nothing on fishery	Establishment of stakeholder Mgt committees;	Gov't of Trinidad and Tobago, 2013
	7. Inter-Agency & Cross Sectorial Partnerships	1	No information on fishery or community	Adaptation partnership; MACC and SPACC project	Medeiros et al, 2011; IISD, 2011; MACC, 2012; SPACC, 2013
	8. Climate Change Mainstreaming Initiatives	1	No information on fishery or community	Climate Change Mainstreaming Initiatives	Gov't of Trinidad and Tobago, 2013
		1/2			
Adaptation Decision Making and Stakeholder Involvement	9. Non-State Actors Involvement and Participation	2	Information on community nothing on fishery	Greater leadership and ownership of national programmes at the community level	ECLAC, 2011; Gov't of Trinidad and Tobago, 2013; Caribsave, 2012
	10. Public Engagement	2	Information on community nothing on fishery	community-based rural infrastructure programs; non-governmental organisations; community based organisations	ECLAC, 2011; Gov't of Trinidad and Tobago, 2013; Caribsave, 2012
	11. Education and Awareness, Curriculum Dev.	2	Information on community nothing on fishery	Training of community groups in aspects of natural resources management; Education, Awareness, Capacity Building and Institutional Strengthening	ECLAC, 2011; Gov't of Trinidad and Tobago, 2013
		2/3			
Climate Change Information and Research	12. Research Institutions (National Academies/Universities/Think Tanks/Ngo)	2	Information on fishery nothing on community	Institute of Marine Affairs; Fisheries and Aquaculture Research Programme	ECLAC, 2011
	13. Knowledge on Vulnerability Hotspots/Hazards/Regions	2	Information on fishery nothing on community	CCCCC; Caribsave, 2012	CCCCC, 2013; Caribsave, 2012
	14. Scientific Agency/National Assessments (NAPAs/NAPs)	1	No information on fishery or community	National CC issue paper/report	Gov't of Trinidad and Tobago, 2013
		5/9			
Funding for Adaptation Planning	15. Climate Change And Adaptation Funds	1	No information on fishery or community	Green Fund; Inter-American Development Bank; GEF	GEF, 2013; IDB, 2011/2
	16. National Budgets (Sectorial Contributions)	1	No information on fishery or community	Budget with env't and CC allocations	Gov't of Trinidad and Tobago, 2013
	17. Private Sector Contributions (Co-Funding, PPP, Pes, Green Leasing,)	1	No information on fishery or community	Inter-American Development Bank: GEF,	GEF, 2013; IDB, 2011/2
	18. Foundations/Trust/Crow Sourcing/Multi And Bilateral	2	Information on community nothing on fishery	Cropper Foundation; Inter-American Development Bank	GEF, 2013; IDB, 2011/2; ECLAC, 2011
		3/7			
Science and Technology	19. Early Warning Tools And Technologies	2	Information on community nothing on fishery	Climate and weather information and forecasts, early warning systems	Gov't of Trinidad and Tobago, 2013
	20. Technology Based Interventions (Rain Water Harvesting/Agricultural /Coastal)	2	Information on community nothing on fishery	Several technology based interventions	Gov't of Trinidad and Tobago, 2013
	21. National Technology Needs Assessment Reports	1	No information on fishery or community	National Technology Needs Assessment Report	Gov't of Trinidad and Tobago, 2013
		5/9			